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LIFE MAGNIFICENT

LIFE MAGNIFICENT

BY

HENRY ATKINSON

LONDON:
WATTS & CO.,
5 & 6 JOHNSON'S COURT, FLEET STREET, E.C.4

First published 1941

Printed and Published in Great Britain by C. A. Watts & Co. Limited,
5 & 6 Johnson's Court, Fleet Street, London, E.C.4, England

TO THE
YOUTH
OF THE
WORLD

"And if your honest efforts, verified by many tests, decisively indicate to you new paths differing from the old, then—follow your own conviction beyond any other. That is and must remain your highest, your most precious possession, for just as training for scientific independence is the highest aim of academic instruction, so does a scientific conviction acquired by honest work give a firm anchorage for holding fast to a moral conception of the universe in face of all the vicissitudes of life."

MAX PLANCK.

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PART I

MAN IN RELATION TO SOCIAL ENVIRONMENT

CHAPTER I

LIFE AND INTELLIGENCE

THIS is a book concerning life. Most of the experiences of life are common to all people; we are born, we live for a certain time, we die. In that journey from birth to death we breathe, crawl, walk, think, suffer, work, play, gratify our desires, and we do all sorts of things in common with most other people.

But we have experiences peculiar to ourselves that others may not have had, or at least we think so. In the great majority of such cases these, however striking, are soon forgotten because they are, generally, isolated experiences and are not repeated. Sometimes, however, a series of experiences occurs which is so impressive that a new meaning is given to life, a meaning which makes it so much greater than the life of ordinary everyday affairs that it seems imperative first to look at it again from this new angle and to test the truth of it, and then, being satisfied, to endeavour to explain this new point of view in order that others, if they will, may examine it for themselves.

This book is such an endeavour. But it must be stated at once that herein will be found no sudden conviction of sin, no beatific vision, no belief that one has received a "call" to put the world right. It consists only of a considered conclusion arising out of some personal experiences, together with a good deal of subsequent pondering on the problems of life and death and the meaning, if any, of the universe.

It is especially to youth this book is addressed, to those young people thrust willy-nilly into a magnificent world which their predecessors have made, and their contemporaries continue to make, a hell. Not a hell of fire and brimstone and physical tortures, but a hell of untruth, blind thinking, loose conduct, of sins, conventions, laws, politics, wars, of the creation of evil, of frustrations, coercions, threats, restraints, exhibitions of power. But the changes taking place in the outlook on life are leaving youth with open minds concerning its meaning. They find no satisfaction in orthodox beliefs, or in being restricted and thwarted in the ways which nature and the spirit of adventure seem to direct and urge them. The endeavour to "bring them back to the fold" makes them impatient and their expressive language indicates their contempt. No satisfaction is found in new efforts to coerce them into accepting old fallacies. Yet they are uneasy about their ways of behaviour and their morality; they do things of which they are secretly ashamed, and break conventions with violence rather than with conviction.

It is said that this is an age of unbelief and wanton disregard of those precepts which have enabled men to live in the manner prescribed for them by those who have received special instructions from a source other than that of this world. This assertion may be true, but it is also an age of liberty of thought, of surging increases of knowledge, discovery, and invention, of vivid inspiration and broader vision, and modern thought will not be shackled to the obsolete teaching of those enshelled in authority—clinging to age-long shibboleths, gazing ever backwards, and closing their minds to the changes making for a greater, nobler, and truer life—who still endeavour to confine and direct the growing urges for truth and reality to old teachings, worn-out creeds, and dead philosophies. It is for youth to assert itself, to break away from pastors and masters who cannot, or will not, progress with the age, and to carve out its own way to a great and wonderful future.

Nevertheless, if in what follows anything is found which does not appear to be reasonable or true, it must be rejected unhesitatingly, though such rejection is not justified unless it is replaced by something more reasonable or more true. To reject without thought, or from prejudice, or by dependence on some other person or authority for one's thinking, is no way to satisfy the soul; but few who read this will be so serf-bound in thought as to be subject to such limitations.

Not so long ago we had to bear with the teachings of obsolete beliefs because our teachers were unable to stand the shock of the truth concerning that which they taught; truth was set aside or denied in order that belief might be upheld, for "true believers" rarely believe the truth. This stage is rapidly passing—indeed, has almost gone. Youth is more free in thought, word, and action now than ever before, and unwarranted beliefs have neither attraction nor fear for them. The danger lies in their having little or no understanding of the circumstances of life and its environment, or of the influence of one on the other; they have not been taught these things, therefore they tend to contract habits and practices which are anti-social and which will need eliminating—a waste of life, happiness, and progress.

Yet the right ways are so simple and so satisfactory, if only we can find and stick to them. It is wrong to stress the hardship of the way of truth; the fault lies chiefly in a warped and deficient education. The way is neither narrow nor hard; it is made so only by false ideas of sin and conduct, and especially of belief, for how often both in great and small things is it found that belief is the assassin of truth!

How can this way be found—if we wish to find it? The means are within ourselves. We possess an Intelligence which, if its counsel be followed, enables something of the meaning of existence and the relationship between man and his environment to be understood. It helps us with our thinking and in our behaviour, and is ready to aid us in all the multifarious circumstances and events of our lives. It forms the basis of the universe and actually existed before the universe, as we know it, began; but in mankind it has reached its highest expression, so far, on this earth. It may be called by any other name—creator, deity, first cause, energy, force—it does not matter in the least. Here it is called Intelligence because we know of no other single word that indicates so clearly the nature of it.

Remember that men do not consist of isolated organisms distinct from what has gone before or what comes after them. They have within them a direct heritage from the past—not yesterday or a hundred years ago, nor yet from Saxon, Roman, Neolithic, or Palæolithic Man, but from a hundred million years and yet beyond that into the depths of time. They are the survivors and the culmination of the most marvellous series of occurrences in our Sidereal System, probably in the whole universe, and the more one contemplates humanity the more increasingly wonderful, the more incredibly mysterious, does existence become.

Man stands upon his tiny earth in the forefront of the pageantry of the universe—supreme, inscrutable, magnificent; the greatest mystery of infinity and eternity, himself compounded of infinity and eternity, inasmuch as he is the ultimate development of that vast Intelligence which has guided the destinies of the universe from primeval simplicity to an ever-increasing complexity that baffles understanding; compared with him, the resplendent orbs of heaven are but playthings drifting hurriedly but idly away upon the streams and currents of time. The more one attempts a rational approach to the solution of the mystery of man, the better his existence and its meaning may be understood. This approach can be made only with the aid of Intelligence, and here we endeavour to make it, though it may prove a tedious business because the facts of existence are legion, and so diverse and complicated that they cover everything in the universe. But, in man's long pilgrimage from the pre-atom, certain profound changes are noticeable, and an examination of these will enable his development to be followed, and the constant efforts of Intelligence to maintain an unbroken existence beginning with primeval substance and culminating in man will become evident.

After reading this book, our assertions, or some of them, may be believed or not. There are no penalties for disbelief, no punishments or threats of punishment here or hereafter, no priests, creeds, religions, heresies, no torments, and no hells. So one may read freely and without fear, and if the reader denies that Intelligence—which is at once the creator and the substance of the universe—is within him, very well; it will not matter—his Intelligence will carry on just the same, as it does for every other person, be he or she of any creed or race, and it will not lessen its activities on his behalf because of disbelief, though the denial of it renders its task of bringing harmony into one's own personal conscious life much more difficult.

CHAPTER II

EVIDENCE AND REASONING

I

To ascertain the truth about any subject the evidence must depend on either matters of fact or on studied opinion based on a high degree of probability, and such evidence must be put to the proof before it can be accepted. But what is proof? It must be such an interpretation of the evidence that all sane people searching after truth free from any kind of prejudice, coercion, or preconceived ideas will acknowledge it. One may think it should be easy to appreciate what is real and what is true, but we have only human observation, investigation, and reason to guide us, and these are all more or less imperfect. Only on simple and obvious matters can general agreement be reached, and even some of these may be accepted as true at one time and prove to be untrue at another. Until a few centuries ago it seemed to be the most obvious truth that the sun went round the earth; anyone believing that now would be considered insane. Similar considerations apply to the shape of the earth; at one time it was considered to be flat, now it is round. Until the twentieth century the atom was, as its name indicates, indivisible; now it has a complex structure and can be split up into component parts.

But it may be stated with certainty that the sun will rise tomorrow morning—surely this is true, and it *is* the same sun. Well, the chances are that the sun *will* rise tomorrow, and we can arrange all our actions and affairs in relation to it unhesitatingly. It will, however, not be precisely the same sun that rose this morning; it will lose 432,000,000,000 tons of its matter between six o'clock this morning and six o'clock tomorrow morning, and eventually there will come a time when it will rise no more; as neither we nor any other kind of man will be there to see this phenomenon, it need cause us no uneasiness. Yet even this apparent certainty of sunrise contains the germ of uncertainty; the sun of today is not exactly the sun of tomorrow.

While we are justified in accepting truth on authority alone if the reservation is made that we may, given the opportunity and the mental equipment, examine the evidence and satisfy ourselves that the authority is trustworthy, it is well to remember that frequently the truth is but a working hypothesis where the evidence is indirect. All assertions about the atom and its structure can never be proved because the atom can never be seen. Only its effects are observable, but these are so constant and so obvious that its existence and properties may be accepted without hesitation, just as one accepts the rising of the sun.

But concerning existence, or any statement about existence, it is imperative that the accuracy of the observations and of their interpretation be beyond question, and that any definite or provisional conclusions drawn from indirect evidence shall be of such a nature that rational unprejudiced persons will accept them as working hypotheses even if they are acknowledged to be only a means of ascertaining a more complete knowledge of the subject under consideration. On this principle the evidence concerning the atom, the ether, the mathematical basis of the universe, existence itself, may be accepted if guaranteed by a competent authority.

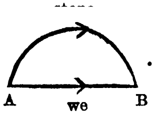
Existence is a profound mystery and seems quite insoluble to man; but the nearer we approach to a knowledge and understanding of the *conditions* of existence, the nearer we shall be to solving the mystery, even though a complete solution is impossible.

In relation to events two things become apparent: first, events occur; second, these events are noted and registered. The events which occur constitute existence; the noting of them is made by Intelligence. Conversely, if no events occurred there would be no existence, while if events were not noted there would be no knowledge, memory, understanding, or reasoning. Indeed, in the ultimate, if events were not noted by something they would virtually not exist. That is why history before building, painting, or writing is almost entirely non-existent. Even a moving particle must be noted by something, because it must move in relation to something other than itself, it must have an environment; if there was nothing else in all the universe but one particle, how would it be known whether it was moving or stationary? Such a particle would have no size, mass, movement, gravity, inertia, heat, light, electricity—nothing. Thus, an environment of some kind is essential to existence of any kind.

In what follows it is intended to deal chiefly with evidence of a scientific nature which is generally of sufficient accuracy to justify acceptance of it. Conviction, opinion, faith, do not carry any weight unless they are based on incontrovertible fact. Evidence, thought, reasoning are closely linked together. Thought cannot operate without evidence, reason cannot operate without thought. Evidence may be simple and direct, as when a stone thrown upwards returns to earth; or it may be extremely involved, as when dealing with atomic structure, theories of heredity, the state of life after death. In all cases evidence must be received through the medium of the senses and impressed on the brain; the reason then determines by the nature of the event and by comparison with what is already known whether it is true or untrue, or whether it is insufficient for a decision to be made in connection with it. In many cases of great importance to man it is very difficult to obtain accurate evidence or to determine, when evidence is put forward, whether it is accurate or not. Frequently it must be accepted only provisionally until further evidence confirming it has been obtained—this is common in science. Frequently, again, evidence which is obvious and truthful is suppressed or denied for some special purpose—this is common in politics and religion. The value of evidence, therefore, must be judged very carefully if the truth is to be made manifest.

II

Most phenomena have a reality behind their appearance which may alter their value and enable a more accurate interpretation to be placed on them. Here is a simple case: it is said that a stone falls to the ground. The ordinary man will agree with that statement, but the mathematician will qualify it. He will endeavour to show that there is an attraction between the earth and the stone, and that the stone does not really fall to the ground, but that the mutual attraction of stone and earth will give it that appearance, whereas really the stone and the earth are drawn together. The earth, having a much greater mass than the stone, will seem to remain stationary and the stone will seem to move; but actually they both move towards each other, the stone drawing the earth to it just as much, proportionally to its weight, as the earth draws the stone.

If we throw the stone upwards it returns to our hand. We say we have thrown it straight upwards, and it falls straight down again. The mathematician will again qualify this statement. He will point out that the earth is revolving on its own axis at a speed of eighteen miles a minute at the equator and the stone which is apparently thrown upwards follows a curved path, due to the initial velocity with which the stone is projected upwards, together with the movement of the hand at the same instant, because our hand is travelling at the same speed as the earth. The real trajectory of the stone is not vertical, thus: ↑↓, but curved, thus: 

. We were at A when the stone was thrown up; the earth has carried us to B when it returns to us. The mathematician will now show that the earth is travelling round the sun at a speed of eighteen and a half miles a second, which gives the stone a much more complicated trajectory than that just stated. He will then show that the solar system is moving towards Vega at a speed of fourteen miles a second, though not in a direct line. And so on. The stone therefore moves in a curvicular trajectory which escapes imagination—yet it is all perfectly true.

The common man again throws up the stone, and it still falls back into his hand in an apparently straight line. For suppose it did not do so. Then it would, (1) not fall to the earth, or, (2) not fall into the man's hand. But both these are contradictory to the simple fact that it does so, and all the mathematicians in the world cannot alter that. Of course, the man, moving at the same rate as the earth, follows the same curves as the stone, apart from its relatively vertical movement; that is why it returns to his hand.

There are two interpretations of this simple phenomenon, one being the *appearance* of what happens—i.e., the stone has a vertical movement—the other the *reality* of what happens—i.e., the stone follows a very complicated curve. In each case the end is the same—the stone returns to the man's hand. The Principle of Relativity seems to complicate the matter still further, but again the end is just the same.

One is apt to draw the conclusion, therefore, that reality has little effect on experience and that only appearance matters. This is largely true, but it is not the whole truth, and that apparently smaller part which deals with reality proves in the long run to have a very important bearing on our lives, because it enables error to be detected in many forms, the fundamental basis of the universe becomes more rational, and we are able better to understand the position of man and the meaning of life in relation to the universe. If this meaning can be found, or if we can get reasonably near to it, we shall be able to readjust our lives in accordance with it, for we shall be nearer to the truth, and this will necessitate changes in us, great or small, if we are to take advantage of this new understanding and to put ourselves in greater harmony with existence.

This understanding of reality extends wider and wider and causes become simpler and simpler, even though the mathematical approach to them becomes more and more complex. But the common-sense person is entirely correct in his statement that a stone falls to the earth, his only error, if it can be called an error, being that the statement is only part of the truth instead of being the complete truth; all subsequent investigations only amplify this truth, they do not deny it or alter it or destroy it. There is *sufficient* truth in it to enable all our affairs to be conducted with regard to it in a perfectly satisfactory manner so far as our lives and general welfare are concerned.

III

As an instance of change in values the progressive development of knowledge concerning the earth's relation to the sun may be mentioned. In his study of neo-Platonic philosophy, Copernicus was impressed by the daring suggestion that the earth travelled round the sun instead of the sun round the earth—the then-accepted principle. He made many observations, and became convinced that this suggestion was borne out by the evidence and that it introduced a greater harmony in the movements of the heavenly bodies than had ever before been demonstrated. Though his knowledge of dynamics was insufficient to enable him to prove his statements, and though his explanation was not accurate because he thought the planets moved in circles round the sun, it was much more satisfactory than the existing belief. It was accepted by Kepler, who formulated the law which explained the elliptical movement of the planets whereby a line drawn from planet to sun will sweep out equal areas in equal times as the planet moves round the sun. When it is nearest to the sun the line moves faster (the speed of the earth being constant), which explains why the areas are proportionally equal. Galileo followed with a clear mathematical account of this elliptical planetary movement. The great principle underlying these movements was later discovered by Newton, and demonstrated in his theory of Universal Gravitation, whereby all particles of matter attract all other particles of matter in relation directly to their weights or masses and inversely as their distances from each other. Thus the movements of the planets in relation to the sun became an established evidential truth.

The result of these discoveries was to bring about a serious change in values in the minds of men—namely, the belief in the "apparent" fact that the sun travelled round the earth was discarded in favour of the "real" fact that the earth travels round the sun. Incidentally, it altered ideas about religion so drastically that the facts were denied and the belief in them condemned by priests until over two hundred years after the evidence of the truth was demonstrated to all unprejudiced and unbiased men.

Further demonstrations and mathematical calculations are now showing that what has just been called a "real" fact may not be the actual basic fact, which places us in the position of the person who finds that a stone projected upwards comes back to his hand—that is to say, we shall still find that the earth travels round the sun even though Newton's theory of gravity is discarded in favour of the Theory of Relativity. We must always be prepared to accept new explanations if they can be shown to have a more accurate or more complete basis, for we may rest assured that our greatest safeguard concerning the accuracy of such explanations is the criticism not of religion or of philosophy, but of science itself.

In this connection there is great difficulty in understanding the reality behind certain abstractions, and even of some commonplace phenomena. For instance, we can think of a yard, a mile, a thousand miles, and we are of opinion that we can think of a million miles, though this is not easy; but infinity eludes us. When we endeavour to think of the boundaries of space and our thoughts can go no further, there seems still to be something beyond, something we cannot think about because we have reached the limits of thought concerning space. The Relativity and Curved

Space of the mathematicians may be logically true, but nothing can prevent us from feeling that outside this universe which is limited by Curved Space there must be more space. Again, we can think of an hour, a year, a thousand years, a million years, but eternity is beyond us—there was always something before the beginning, there must be something after the end. One cannot think of an actual *end*; where would everything *be*?

Similarly, we *think* we can think about matter, immortality, omniscience, absolute zero, a first cause, and what not; but we cannot grasp the real meaning of these words, because the brain was not developed for the purpose of thinking about such illimitable subjects. It was developed to enable the individual to survive the exigencies of its immediate environment. In his struggle to exist man had to contend with material things, and the mark of the struggle is on him from the cradle to the grave, from the germ cell to the brain. And reason, being dependent on the brain, is unable to grasp the meaning of abstractions and illimitable ideas which have no direct existence, which do not contact with the senses.

But why do these abstractions *seem* to have meanings? It is because thought cannot stop when the limits of actual experience have been reached. The sense of taste develops in accordance with the foods available; but it does not suspend its function when those foods are not available, it tests new foods and also things that are not foods. New chemicals are discovered, and substances are manufactured with entirely new tastes. Sight is not limited by things seen—new aspects of form and colour are imagined, and so Art is conceived. Music is artificial and arises out of natural sounds. It is the same with thought. When the limits of experience have been reached, thought imagines nobly, it conceives ideas; it invents words for these ideas and imaginations—words which seem to have meanings—and we rack our brains to find these meanings, only to discover after many years of wasted mental effort that we are seeking the end of the rainbow.

IV

The words finite, mortal, science, matter, nature, mean definite limited things or ideas. But in order to contrast these things or ideas with extensions beyond their limits, words are invented for the expression of these extensions—namely, infinite, immortal, eternal, omniscient, infallible, immaterial, supernatural. Loose thinking endows these words with definite meanings: it is assumed that infinity and eternity actually exist, that life can become immortal, that there is a supernatural state beyond nature, that deity must know everything and possess a mind (which implies a brain) of some sort and can and does help mankind materially and mentally. But all these have no existence whatever, and so grave and enormous errors arise out of words which have been devised merely for enabling us to contrast the definite with the indefinite. A world, a universe, beyond that of actual fact is declared to exist: philosophers brood over it and invent theories about it; priests calmly commandeer it and people it with fanciful creatures; seers and mystics have visions of it and assume authority about and over it; yet it is a universe of words only. Immortality, for instance, means that all men will live for ever and for ever and for an infinitely long time afterwards. Thought cannot grasp the meaning of this because when we have thought of "for ever" as far as possible, it still continues. And consider omniscience; this means a knowledge of everything, the detail of every muscle, bone, nerve, sense, gland, corpuscle, cell, in the body of every human being, every animal, insect, fish, worm, protist, that lives or ever has lived; of every occurrence that is happening or that ever has happened in all the universe; every motion of the wind and of the stars; every degree of temperature in every part of the earth, in the stars, in ourselves, in the smelting furnace, in the ether; of the movement of every atom, and of every electron in every atom, in the universe; of the incidence of every ray of light and its effect on organic and inorganic matter; of every thought that passes or has passed through the mind of every person in the world since the world began; and countless millions of events occurring at every moment of existence—all completely beyond our thinking.

So it is with the other words enumerated above, and scores of meaningless words may be added to them; one must conclude that the real uses of such words have been distorted, that they are an endeavour to limit the illimitable, and that their original relative purposes have been overlooked in the desire to make them mean something definite and circumscribed. Some of them may come within measurable distance as knowledge increases—gravity, light, heat, motion, matter, thought, are so near to us and we are so dependent on them that we feel their reality must sooner or later come within our exact knowledge. But the vague and frequently false meanings applied to them at present lead to great confusions in the endeavour to think about them clearly, which adds much to mental labour in the effort to understand them.

V

Now examine for a moment evidence concerning religion. In Egyptian religion the evidence for Isis, Osiris, Horus, and many other gods and goddesses was non-existent; this is quite certain, yet these deities were accepted by reason for over 5,000 years. Now they are rejected, but why? There has been no change in man's reasoning powers since the time when these deities were worshipped, and the evidence for them is exactly as good or as bad now as it was then. It may be said that times have changed, or that these deities have been displaced by other deities, that there is greater truth in the Trinity of A.D. 1940 than in the Trinity of B.C. 1940. But is there any greater evidence in one case than in the other when it is examined closely, without prejudice of any kind, without coercion or bias? If the examination of evidence and the exercise of reason in its interpretation are brought to bear in this subject, will not the deities of the present day be transferred to that limbo now inhabited by Isis, Osiris, Horus, Zeus, Jupiter, Mithra, Odin, the Great Spirit, Mumbo-Jumbo, and a host of other greater or lesser deities, ancient and modern? It is all a question of real evidence and its proof, as was mentioned at the beginning of this chapter.

The ultimate achievement of true values is perfect knowledge and understanding of the universe and its meaning. The reasons why Intelligence has passed through all the successive stages of development and why it seems to have imprisoned itself in matter, unable to attain perfect expression except through the gradual changes of organism and environment—the two aspects of Intelligence—will then become as evident as any other natural phenomenon.

These are matters to be dealt with by the man of the future, and it is a waste of time, thought, and life to attempt vaguely to interpret them with our present limited understanding. On the other hand, the adventure of thought from the solid ground of fact into the oceans of the unknown under the guidance of the scientific spirit has resulted in discoveries of the utmost importance to the world, and the universe will yield up its secrets a thousand times quicker by this method than by any amount of guesswork, thoughtless assumption, and other-worldliness.

The object of this chapter is to impress upon the reader the necessity for bringing his mind to judge freely, clearly, and without any sort of coercion, prejudice, or favour in connection with all sorts of statements he meets with during life—statements about conduct, politics, life, religion, science, news, customs—and especially for examining and judging the evidence put forward for them and to use his reason in endeavouring to arrive at the truth of anything. Above all, he should use his reason in judging the evidence and assessing the values of what follows herein.

CHAPTER III

THE BASIS OF INTELLIGENCE

I

Now let us examine man a little. He has not created himself; his senses, thoughts, will, reason, have not created him. Yet he is here on earth and must have come from somewhere—that is to say, something apart from these must have been responsible for his appearance. But what? Is it something outside himself? This cannot be so, because it assumes some power having an existence apart from and outside man and also outside all matter of whatever form. No such power is known. Moreover, it would mean two distinct existences, one being that which created the universe and the other being the universe itself. A creator must be within the universe created, or outside it and apart from it, or must encompass and contain the universe as part of itself.

However positive these assertions may seem, a careful and exhaustive, unprejudiced study of the facts and the quality of the evidence brought forward for each of these three possibilities—and there seem to be no others—will show which is the most probable, for there is no real evidence whatever to support the opinion that a creator exists outside the universe, nor of one which contains the universe within itself. It seems, therefore, that the originator of all existence is something within the universe, and if so it must be something intelligent, for it is responsible for all the development that has taken place. It should be found associated with every part of the universe from highest to lowest, from the greatest complexity to the utmost simplicity, inasmuch as it is at once the most fundamental principle in existence as well as being the basis of organic being, of consciousness, of thought.

In the absence of a logical explanation of existence, many past and present peoples have asserted that an intelligent first cause, creator, divinity, or spirit, made every existing thing and that it made them all out of nothing. This, again, is unsupported by any evidence, but it amounts to an acceptance of the principle of Intelligence, and all that is claimed here is that Intelligence is within the universe, within existing things, within all development, not outside it; and that, in consequence, everything consists of Intelligence itself. It may not at first sight seem to be a very great distinction, but it leads to an understanding of the origin, progress, and destiny of the universe which is fundamentally different from that which is generally accepted.

Many difficulties arise in connection with the orthodox or classical accounts of creation. For instance, if the origins of the atom, the molecule, the whole universe—nebulæ, stars, planets, organic matter, the development of organic forms—are all due purely to creation or to chance, it is difficult to understand the origin and development of matter, the origin and existence of what is called natural law, the origin of man. A consideration of matter, life, environment, and evolution seems rather to point to a control over all origins and developments from the most primitive substance to man—a control which seems necessary, for instance, to account for certain important properties possessed by the human organism, such as the power of repairing injury, of adapting its parts to new circumstances, of responding to suggestions and requests made by thought. Only some sort of control within the organism can account satisfactorily for these occurrences, and as there is an intelligent motive in bringing about these repairs, adaptations, responses, this control must be an intelligent one—that is to say, there is an Intelligence in active operation in connection with them.

The alternative is to assert that this is untrue, that these occurrences take place without an intelligent motive, that they are machine-like actions operating as cause and effect; this is also to assert that the development of the whole universe is automatic and unintelligent, from its basic structure to the thoughts in the minds of the person writing and those reading these lines. This may be true; it is a question of evidence and its interpretation, and the meaning of words.

Some simple observations concerning man's organization may provide evidence in this connection and may enable us to draw some conclusions about the possibility or probability of intelligent control. Our heart beats, we breathe, we think; our cut finger repairs itself, our broken leg mends itself. We have no control over our breathing or the beating of our hearts; we cannot control, and we cannot prevent, the repair of a cut or a broken limb; we cannot stop our thoughts.

There are three ways of accounting for these actions. First, it may be assumed that some external agency controls them. It has been shown how improbable this is, for unless such an agency is active during every moment of the existence of every animal, plant, and atom, it must step in only as and when required, or when it desires, to make every heart beat, every lung breathe, every brain think, mend every broken leg, control the production of every one of the 20,000,000 red blood corpuscles which every man produces every second of his life. (These are only a few of the millions of things which such an agency must control in man—think of all other organisms, hundreds of thousands of species of insects alone!) Where such an agency exists and how it performs these wonders is impossible to conceive.

Second, these things may control and mend themselves; this is the commonly accepted explanation. The "crass" materialist believes this to be the real explanation. In the long run, he says, it is all mechanism, physico-chemical action, response to stimulus; all conduct is cause and effect; all behaviour is due to complexes, inhibitions, primary, secondary, or conditioned reflexes; all evolution is the result of combinations of genes which produce a body that survives or is eliminated by the action of Natural Selection. There is much truth in all this; it fits many facts and satisfies the enquiring mind much more than the assumption of external interference. But almost all who profess to believe this do so with reservations; when they enquire into First Causes, Natural Laws, Properties of Matter, they acknowledge these to be beyond understanding, and so "the Mysterious Universe" replaces the external controller.

Third, it may be that all our actions and all the phenomena of the universe are controlled by something within it and which is an essential part of it. This would account for the actions of our bodies, but the difficulty is to imagine how a power of this nature can reside in the body, being born when it is born, dying when it dies, and during life exercising such enormous yet such detailed control. But this is actually what occurs, and this power is here called Intelligence.

II

It will be at once apparent that such an Intelligence is something much more than ordinary every-day intelligence. It has accompanied man during the whole of his development, and if that development be examined in all its aspects we may arrive at an understanding of the comprehensive and universal nature of Intelligence. For reasons already mentioned, the origin of man's intelligence cannot be outside him, and he has got beyond the stage when it was necessary for his mental satisfaction to assume an exterior cause for anything the origin or meaning of which was not immediately apparent. This being so, where shall we look for it within him? Is it in the brain? One is inclined to say it must be, because the brain has for many years been considered to be the seat of the intellect, which is true enough, but not the whole truth.

Is it a peculiarity of man's brain only? Have the lower animals any intelligence? If it is agreed that they have, the line of intelligence may be followed down through the animal kingdom. If it is said they have none, then this is to assert either that man has no organic connection with the animal kingdom, or that, if he has, his intelligence must have been a special endowment from a source other than that of organic development, inasmuch as he is possessed of it, and the animals with which he is connected are not. Let us consider these assertions. If man's intelligence is a special endowment, how and when did he receive it? Was it during historical times? The whole of the evidence is against this, because there are signs of great intelligence in the archæological relics left by prehistoric man, and still more in his domestic animals and plants, all of which were derived from wild species. It must have taken many thousands of years for man to train and breed the dog from the wolf and the fox, and to convert the wild progenitors of cereal plants into the wheat, barley, oats, maize of the present day, especially when it is considered that during the 7,000 to 10,000 years of history the advance has been very small until the last half-century or so. Man's intelligence, therefore, came into existence long before history. Was it conferred on Piltdown Man, Neanderthal Man, Lewes Man, Galilee Man—those early men who seem to be in the line of development between modern man and the common progenitor of all men and the man-like apes? No one can tell. But all these types certainly had considerable intelligence compared with the lower animals, so that even if animals are assumed to have no intelligence, it is still quite impossible to say when *man* received it, and every known fact supports the opinion that intelligence was not received from some source outside man himself. As to the question of how he received it, this is equally impossible to answer unless it is assumed that somewhere between the highest animal, whichever that is, and the lowest man, whoever that was, a new form of being something like man was created out of nothing and endowed with intelligence. If so, then ever since that creation this man-animal must have been evolving side by side with contemporary evolved animals, changing in the same manner in the same environment, as well as procreating in exactly the same way. This new creature must obviously have been lower than modern man—this is well seen in the skeletons and the low brain capacity of fossil men—which means that modern man has *evolved* from it, just as modern animals have evolved from lower types. But, if such an evolution occurred from this lower man-animal to that of modern man, its lower intelligence could just as well have *evolved* from that of a highly developed animal without the necessity of an intervening creation, for it is certain that the lower types of men so far discovered approach more and more nearly to an animal type such as that of the gorilla and the chimpanzee. There is no apparent reason why such a change should not have occurred, and there is plain evidence all around us in present circumstance and past history that this has been the way of the development of man's intelligence. The idea of a *created* intelligence somewhere between the highest animal and the lowest man known becomes so incredible that it will not be considered further here, and it will be accepted that man's intelligence, as well as his form and structure, has been derived from an animal type which has long ago disappeared, and this disposes of both the assertions concerning the non-intelligence of animals.

Intelligence, then, is not a peculiarity of man's brain alone, but animals are also possessed of it, though in them it is not so far advanced as in man. How did it develop in animals? We must look again to development to discover this, and the intelligence of the highest animals is found, with less and less intensity, as the brains and the behaviour of the lower types are studied, but there is continuity through all the stages of the mammalia, thence through the amphibia which can live both on land and in water, through fish and worm, until eventually it may be observed in a very primitive form in the single-celled animal, such as the amœba. And at no stage can it be said: "Here intelligence *originated*!"

Is this to assert that the intelligence of man is to be found in the amœba? The same kind, yes; the same complex form, no. For, if it is not the same kind, then that exterior power must again have stepped in and bestowed another kind of intelligence on some form between amœba and man, and this must be rejected just as created intelligence in man was rejected. Then, did intelligence begin with the amœba and continue with increasing complexity to man? To the first part of this question, no; to the second part, yes. Intelligence cannot have originated in the amœba because there was protoplasm before the amœba—that protoplasm which is common to all organisms. Well, then, it arose in protoplasm? No; interference cannot be admitted at, or in, any stage of development. (This is not being stubborn; it is only clearing away unnecessary intrusions by exterior influences into the steady, even process of development.)

From protoplasm we pass to the colloid molecule—those highly complex groups of atoms which form the foundation of protoplasm and hence of organic being. Thence to the crystalline molecule, the atom, the proton and electron which form the atom, even to the substance of which electron and proton are formed—and nowhere is any origin of intelligence to be found. But if these forms had no intelligence they could not have existed—they could not exist now—and if it has been present always it must have been active always. Hence physical, chemical, and organic matter have always been accompanied, activated, controlled, and guided by an Intelligence. Hence, also, it must have preceded these activities, because they cannot have come into existence before the Intelligence which caused them. An exceedingly important conclusion, because it means that *this Intelligence preceded the formation of all matter and all phenomena.*

III

This endeavour to trace intelligence back to a possible or hypothetical origin is made only for the purpose of showing that intervention by an external power in the affairs of the universe is not necessary, quite apart from the improbability of such a power existing. If an origin of this nature be accepted, whereby intervention is ruled out, the subsequent development of Intelligence through matter, life, man, reason, to its present stage is only of casual interest to our theme. What *is* necessary is to understand the relations to each other of matter, life, man, reason, environment, and to consider the desirable ways of continuing them. But occasionally there are seemingly drastic changes in the forms or associations of matter, and out of these there arise new phenomena which have disturbed the smooth flow of the evolution of merely expanding forms of the same nature. These changes are epochs of such a revolutionary character that a less enlightened generation found, and less enlightened individuals of the present generation still find, possibilities of external intervention in the development of the human race, with its intelligence, from a simple inorganic state.

The origin of man from some lower form of animal is one of these; the origin of "life" is another; the origin of organic matter is yet another. Beyond these there are others which are so remote from mankind that the interventionist is indifferent concerning them. But to the physicist, the chemist, the psychologist, they are of supreme importance. The development of consciousness and human understanding, the development of the organic from the inorganic, the meaning of the chemical association of molecules and atoms, the relationships between the weights and chemical properties of the atom, the evolution of the complex atom from the simpler atom, the occurrence of isotopes in the atom, the relationships between different forms of energy, are some of these. But, as knowledge increases, the more these epochs fall into natural sequences of change and development, and from the constant forging of links in the endless chain of evolution, one may say with confidence that only lack of knowledge prevents the completion of the chain from atom to man. The facts are there, but they have not yet been discovered.

Now, does all the foregoing rule out the suggestion that all activity and development are in the nature of a machine, or that they are but physico-chemical reactions? The suggestion of a machine-like nature can be ruled out at once, because no machine can go on working for many years and then produce another miniature machine from within itself which will grow until it is similar to, but not exactly like, itself, and the working of which in some respects is different from the parent machine. Nor can a machine adapt itself to changing external conditions in order to maintain its existence. Should it be found that some iron and carbon mixtures and compounds arranged themselves in such a manner as to form machines, engines, etc., and that they could repair themselves from within themselves when damaged or broken, the machine-like nature of organic matter from carbon compound to man could be argued; but we have, so far, no evidence that any sort of machine has been developed in this manner, and the circumstances of inorganic nature make such a development seem to be impossible. There are other reasons why the machine comparison breaks down, but the whole suggestion is too absurd to discuss when one gets down, shall we say, to "brass tacks."

Physico-chemical reactions as the basis of action and development may be asserted with greater reason, but if this be accepted, then the consciousness, thought, and intelligence of man are all physico-chemical reactions. The materialist has no hesitation in asserting this to be the case, and the influence of the ductless glands on growth, emotions, mental development, and so on, to some extent bears this out. This means that all organic action and development should follow exactly the rigid lines of chemical or physical action. But ever and again changes occur which depart to a greater or less extent from such direct action, and the physicist, chemist, embryologist, biologist, must frequently appeal to or admit something unknown to account for these departures. It is claimed that fuller knowledge would provide explanations for them, but all existence is due to change and development of a primitive substance, and this could never have taken place by physical or chemical action alone—something must have caused, must have preceded, this action. In his laboratories the intelligence of man prepares synthetic chemicals; in its laboratory of the universe the Intelligence of Nature prepares the atom, the molecule, the carbon compound, the living colloid, and man himself. The biological chemist has all natural physico-chemical action and reaction to guide him; Intelligence has no guide but itself; yet it experiments and creates from within itself all the phenomena of existence.

Again, physico-chemical action ceases when no more material is available under certain conditions of temperature, pressure, and environment; it may change if its environment changes, but only within the limits of its substance and structure. It cannot cause any change in itself or in its medium by its own purely physico-chemical efforts. Intelligence must obey these conditions if it is only a physico-chemical reaction—but it does not ! An idea which occurs in the brain may very greatly affect the body and cause changes in it. Ideas are the wands of Intelligence, and the conscious mind of man is able to appreciate them because his brain has developed far beyond that condition which is necessary for his survival. Hence we dismiss physico-chemical action also as the method of accounting for the universe and all that therein is.

IV

In hunting down Intelligence we began with that of man's mind and ran it to earth in the primitive substance of which the atom is formed. If we acknowledge that man has Intelligence, then the same Intelligence exists in all forms of matter, and these ever-changing forms are due to its influence and its control. If this be accepted, then many of the difficulties that confront the scientist may be explained.

Apart from the foregoing argument, experience shows that something within man responds to a belief in Intelligence. It is often called the control of mind over body or matter. If it be declared that Intelligence is wholly fictitious, what is it that makes this response to belief? Is it something connected with the nervous system or the endocrine glands or with reflex action? Or is it something outside man of which nothing is known? Is the belief itself the secretion of a gland that reacts or responds to suggestion? The more these questions are considered the more difficult they become, because nerves, glands, responses, reflexes cannot operate without Intelligence. They are phenomena all linked together and controlled—not chance occurrences. The mutual action of mind and body takes place quite apart from purely physico-chemical phenomena because in some manner the body obeys an instruction from the mind, and acts and behaves differently from the manner it would have done without this instruction, and so man's organization intelligently responds to a belief in the Intelligence which controls it.

Intelligence is an awareness of the circumstances of existence of that which it controls. In man its expression is limited by his internal and external environment, the internal environment consisting of relationships within the individual—between parts of the brain, between the nerve cells and the efficacy of the receptive and distributory nerves, between muscles, organs, blood, glands, and especially senses—while the external environment consists of all that exists outside the body, to a greater or less degree.

The mind of man is the highest form of Intelligence that has appeared in the universe so far as we know it. No star that shines can support a being with an Intelligence such as his. Some of the planets which may be assumed to revolve about some of the suns could perhaps produce an organism with a thinking brain, and some of the dark stars may do the same; but, if so, such an organism can differ little from that of man in essentials, no matter what form the organism takes, because the Intelligence which produced it is the same as our own.

If the Intelligence of the universe and that of man are virtually the same, and if it aids him in his living and his thinking, there is no necessity to assume the existence of soul, spirit, mind, ego, or other similar ideas in his make-up. All that is attributed to these words may be found in Intelligence, which comprises matter, mind, and all else, and another great advance in the understanding of existence will result if and when man grasps the meaning of Intelligence and tunes his consciousness to its harmonies.

The nature of Intelligence in primitive substance may seem to be of an entirely different quality from that of man—to be so utterly unlike it that there can be no basis of comparison between them. If so, then by the same argument the material substance of which man is composed must also be so different from the mature man, with all his physical and mental qualities, that there can be no basis of comparison between physical man and the elements of which he is constituted. But we know with certainty that he is made up of atoms, and nothing but atoms, in very complex associations and combinations; if we take away the atoms the entire body and brain of man cease to exist. In the same way, if we take away the basic Intelligence of these atoms, his mature Intelligence would also cease to exist. In each case it is only in the degree of complexity and association that man differs from the primitive substance and Intelligence of which he is the product; but we know more about his mental, physical, and chemical nature than we do about his Intelligence; hence the association between atom and man will be more readily accepted than that between primitive and human Intelligence, unless our argument prevails.

Possibly, even probably, on some planets or stars an Intelligence higher than man's exists, but if so it must have passed through the same stage as that through which man is now passing, inasmuch as we know from astrophysics that the substance of the stars is the same as that of the earth. It originated in the same manner and exhibits the same phenomena. Man himself is directly on the way to such a higher stage—of that there is no shadow of doubt—and if he can consciously get into closer touch with that Intelligence which is already within him, the process may be speeded up enormously.

CHAPTER IV

THE DEVELOPMENT OF MAN

I

THE circumstances leading to man's appearance on the earth are in the highest degree extraordinary, though it is well to keep in mind the possibility of life of some kind appearing in other parts of the universe under circumstances widely different from those which led to the formation of our planet.

On earth, life can exist only when the temperature is between 32° F. and 120° F. Temperatures outside these limits will not support life, though for short periods and under special conditions slight excesses of temperature do not prove fatal. The sun has existed in almost exactly its present condition, apart from loss of substance, for over a million million years. This stable condition is due to its position relative to other stars and to the Milky Way. Where stars are more crowded they cannot remain nearly so long in such a stable condition, and therefore if they had planets, the planetary temperatures would hardly remain constant long enough for the development of such highly complex organisms as ourselves. Again, if the earth were any nearer to, or farther from, the sun, the temperatures would prevent the formation of organic matter.

While we are creatures of the land, water enters so largely into our composition—we are about 75 per cent. water—that it is quite essential to life. Light and air are equally necessary. Hence we must have a source of light, an atmosphere, water, dry land, in addition to a restricted temperature, before man can arise out of the " dust."

The appearance of land seems to be due to the shrinking and folding of the semi-solid earth which led to it becoming a very heterogeneous mass of mountains and valleys, though many revulsions and changes occurred during solidification. But however the mountains and valleys originated, the water formed from hydrogen and oxygen in the earth's gaseous envelope settled into the valleys, leaving the mountainous parts above it as land. Roughly, 30 per cent. of the earth is land and 70 per cent. water, so far as area is concerned. But if the earth were a smooth uniform sphere it would be covered by water to a depth of about two miles. Organic matter could not have been formed at such depths; it originated in the shallows and on the shores of primitive seas, so it was due to this unique formation of land above the water that the physical surface condition of the earth enabled life, and ultimately man, to appear.

In various ways atmospheric conditions had a controlling influence over the origin of organic matter. Light is necessary for life, but the direct light of the sun would inhibit those chemical changes which are necessary for the building up of the colloids; it had to be diffused by the atmosphere before these changes could occur. This diffusion is due to fine particles of dust in the atmosphere arising from volcanoes or by the action of winds on the land. The blue colour of the sky is due to the finer particles of dust, and clouds are formed by water vapour collecting round somewhat coarser particles. The clouds serve as the collecting place for atmospheric electricity, the discharges of which result in the union of nitrogen and hydrogen to form ammonia, NH_3. This falls to the earth and is the source of that nitrogen which is essential for the building up of colloidal matter, the chemical basis of life.

The carbon dioxide, CO_2, in the atmosphere is necessary for the supply of carbon which plants absorb by means of their chlorophyll under the influence of light and so form starch and sugar, without which life could not exist. But, though carbon is essential for life, the quantity in the air is only about one part in 2,500. It acts as a poison if in larger proportions than this; if air contained one part in a hundred life would cease.

There are many other curious circumstances in connection with our earth which have assisted in the evolution of organisms. The distance between the sun and the earth; the revolution of the earth which gives us day and night; the earth's inclination to the ecliptic (the plane in which the earth travels round the sun) which gives us the seasons; the tides and their effects; the mass and gravity of the earth in relation to the atmosphere—these are some other factors which have led to the appearance of life. The strange thing about these and the other factors previously mentioned is that they do not occur in connection with any other solar planet, and the chances against their being repeated are so remote that there are undoubtedly far less planets than stars in the universe. And, besides that, the enormous majority of other possible planets would not possess all those individual peculiarities of our earth which have enabled mankind to originate and develop. It is thus reasonably probable that in the whole universe, the earth is the only planet upon which organisms such as ourselves could be produced. This makes our earthly life the most wonderful occurrence of all existences in the universe.

On the other hand, Intelligence is not limited to earthly life; the whole universe is Intelligence. Its action produced the solar system, sun, earth, atmosphere, land, sea, life, man. But on orbs very different from ours it can have produced forms of life which in principle are similar to ours, but which in constitution, appearance, and powers may be more complex beyond our imagining.

II

Now, what of man himself? His form and nature are almost entirely natural, but his environment is almost entirely artificial. The clash between them has led to all sorts of abnormalities, and we frequently find it difficult to discover the meaning of life amidst perpetual changes in this environment, changes of man's own making.

Since man developed from the pre-human stage, communications between man and man have been established by means of signs, sounds, language, markings, alphabets, writing, printing, and the electrical reproduction of writing and of language. All these are highly important changes in the environment of a being who is in his nature an animal with very much in common with other animals, especially with the mammals, and even more especially with the anthropoid apes—called " anthropoid " (Greek: *anthropos* = man) because in many ways they are similar to man. Man's animal nature makes him cling to animal habits and ideas; only the singular genius of certain persons and of certain peoples indicates that there is in him something more than the mere routine of birth, life, and death. It is only recently that man has known himself to be a living being; before then he was but a mass of organized material endeavouring to avoid dissolution by the guidance of an Intelligence which fitted him to his environment; he knew no more about himself or his surroundings than did the atoms of which he is composed.

He is of comparatively recent development, originating about 500,000 years ago, and his consciousness and self-consciousness have developed along lines different from those of a purely natural creature. The weakness of his progenitors proved in the long run to be their strength. Had they developed a strong physique they would have fought with their contemporaries and developed great physical power, and so lived and died; but even had they lived they would not have become men such as we are—they would have been only strong brutes comparable to the orang and the gorilla. The physical weakness of the primitive animal which was thrown off the original anthropoid stock—an animal probably somewhat similar to the present Spectral Tarsius—resulted in subsequent generations shrinking from violent encounter with the stronger creatures about it and in seeking shelter in caves, and especially in trees, in hiding, and in using its intelligence to escape from, or to circumvent, its enemies, to take advantage of its physical environment instead of fighting its foes, to identify itself with its surroundings in such a way as to keep healthy, virile, and alive, but by the use of wit instead of by physical strength.

When an organ is developed for a specific purpose, that development cannot always be rigidly confined to that purpose—there is a tendency to extend it. The hand that develops for clutching the branches of a tree can also clutch a stick or a stone; eventually it can play on a piano. The eye that sees external objects can also look down a microscope or through a telescope. The stomach digests new synthetic foods. The brain that develops in association with the senses and which controls the motions of the body can also be used for associating things which have never before been brought together; the stick can be used as a lever, the stone can be used as a missile. It needs no great mental advance for a stronger stick to be used when a weaker one fails, or for a heavier stone to be used when a lighter one would not serve the required end—a primitive man who could throw a stone would not throw a pebble at a mammoth; he would use his brain, he would select a heavier stone. He would *select*—that is the mental advance, and a highly important one in principle, though so simple in fact. Thus the brain would adapt itself very quickly to new means of obtaining food and escaping from enemies, and its capabilities would be greatly enhanced by the invention of tools and other means whereby food, clothing, and shelter would be obtained more easily.

Human phenomena arise with the application of the potential powers of the existing brain. We must again emphasize that these powers developed in order to enable man's predecessors to maintain their individual and racial existence. The quickness of perception, the grasping hand, the erect position, stereoscopic vision, intensified curiosity, and many other faculties, arose in co-ordination with, and in consequence of, the developing brain, and as new exigencies occurred the intelligence of the brain was able to meet them, otherwise man would never have evolved. The readiness of Intelligence to meet contingencies enables him to select better methods and devise better means of overcoming the difficulties with which his life was surrounded. This readiness, this adaptability, led to the use of more suitable sticks and stones, the making of artificial implements as aids to his natural powers of defence, offence, and capture. The discovery of how to make fire, the observance of the effects of fire on stone, clay, and sand, the wearing of skins for warmth, the storing of food for emergencies, the building of shelters in open situations, the crossing of streams on logs, all follow comparatively rapidly when the trend of the brain is set in the direction of using external objects as aids to an easier life, one which is better able to survive because of these inventions.

III

What happened throughout the dark millennia between pre-human species discovering the use of the stick and the stone, and the earliest races of man using stone weapons and tools, will never be discovered. We can only conjecture the gradual progress which followed the invention of these primitive implements. Life would be safer and easier, the man could on occasion rest in peace in some cave or other place safe from his enemies, and as he rested his brain would be relieved from the strain of attack, defence, or escape, but as it is always active during waking hours it would naturally turn to the most important affairs of life—namely, new ways of evading enemies or of making more efficient weapons, new means of shelter, new methods of obtaining food.

From the chemical structure of man and the fact that this is in no respect different from that of the lowest forms of life, it follows that he is simply a natural development from one or other of those forms, and his only claim to be higher than they, is his power of logical reasoning. In these endeavours to achieve and maintain an easier existence the brain of the primitive animal must have been very active and its development rapid; the changes in the several parts of the brain of the anthropoids mark this progress.

In time, man conquered his fear of fire, that terrible fear which makes most animals in a state of nature shrink from the neighbourhood of the flames that destroy them, a fear probably engendered by the great forest fires that occasionally swept across their abiding-places. At first it is difficult to understand how man overcame this fear, but it is extremely probable that living in the vicinity of active volcanoes, where fire is confined within definite limits, made this not only possible but easy. Almost every animal appreciates warmth—they love to be in the sun—and familiarity with volcanoes would quickly overcome any natural fear of fire when the animal had reached the stage of preparing a shelter for itself.

From this point the ease of existence would be much in advance of that of other animals, and as the bodily comforts were provided for with less time and energy, the resulting leisure would be spent in the simplest way possible, the cessation from physical labour. Are we to suppose that during these periods of rest the brain became a blank until the animal—or the man, as he may now be called—having consumed all the product of his labour, began to seek for more? This is impossible. His brain would dwell on past events and on probable future ones; this constitutes the primitive abstract thought upon which all subsequent thought of a similar nature is based.

Whatever he thought about, it was a new and novel use of the brain—thinking in peace—and new activities were opened up in connection with it. Eventually he would begin to prepare his tools and weapons instead of selecting natural ones, he would put edges on his stones and chip his flints to make them more efficient, and so eoliths and artefacts appear on the pages of history.

With the coming of leisure and need for artificial aids in maintaining life there is a drift away from the animal ways of living, and soon man begins to associate effort and results—he begins to think logically. At first he could think of events only in terms of their immediate effects and would not connect causes with them; but the use of the stick and the stone, the floating log, the heat of the fire, gave subjects for thought, and he began to find reasons for things, and so to anticipate—he discovered the future. And, had he known it, he thereby discovered the principle of Intelligence. In his dreams, in his fears of enemies, in the flickering shadows of his fires against the trees and the walls of his caves, in his reproduction of creatures like himself, he discovered mystery. Later on, when he cast his eyes up to the stars and found their positions changing with the changing seasons, his awe and wonder induced him to believe that the stars guided and controlled the seasons. This guidance and control could be due only to the same kind of thought as his own; therefore he assumed that the stars were strange symbols of beings like himself but vastly greater and more powerful in every way—and mysterious beyond thinking.

IV

From this period progress can be traced with some degree of accuracy, though the manner in which wild races of plants and animals were converted into domestic races is still unknown. For our purpose we need not dwell further on the progress of man from palæolithic times to our own. This may be found in many books, but we may pause for a moment to note one particular group of primitive men —namely, the Cro-Magnon man, found first in Gower, South Wales, and to a much larger extent in a cave at Cro-Magnon on the river Vizere, Dordogne, France, in 1868. These men lived some 30,000 years ago, and were tall, with a brain larger than that possessed by any other men who have yet lived, the brain of the woman being larger than that of modern man. They were highly intelligent, had a considerable degree of technical and artistic skill, the women being dressed in skins sewn together and wearing ornaments of bone and necklaces of ivory. The drawings and paintings on the walls of their caves are very artistic and lifelike. To them is probably due the first outward expression of human thought. It is likely that they attempted to domesticate the horse, because they certainly possessed dogs and cattle—and they understood the sowing and harvesting of grain. How and why this race vanished is not known, but the men who followed were not of the same high standard of mental development, and it is perhaps the greatest tragedy of mankind that Cro-Magnon men ceased to exist. Had they not been destroyed by climatic conditions, by disease, or by lesser men, Intelligence by the present time would have been a million years ahead of its present stage of progress, considering the progressive rate of increase in invention, discovery, and research during the last 250 years.

Why should men, especially primitive men, desire to draw or paint things—animals in particular? And why on walls in caves? Is it a religious desire, a desire for expression, or what? Or did it arise from an attempt to describe some particular conflict showing how victory was achieved in a contest with man or animal? Was it boasting, or was it teaching? Perhaps it arose through picture-writing, by some man drawing in the sand on the floor of the cavern just how he overcame his enemy, man or beast; or perhaps some man used this method to explain to his fellows how some hero of the tribe died! It would not be a very great step from this to the use of pigments; red rock would provide a very suitable material for illustrating blood shed in the strife, and children would already have scrawled meaningless marks on other kinds of rock with this soft red stone. The use of colours would be suggested by this red pigment, and other colour materials would be sought. It is generally assumed that men made the drawings in prehistoric cave-dwellings; but why not women? They would have more time for this when the domestic work of the cave was done, and would not this sort of art appeal more to them than to the men who had to go out hunting, fishing, fighting?

In this primitive art we have actual evidence of the high mentality of the cave-man. It indicates thought, leisure, judgment, peace, skill, industry, and, above all else, originality. It is easy to follow where the pioneer has blazed the trail, but the greatest minds are those which venture out into the unknown upon new adventures leading to greater knowledge and the mastery of the brain over circumstance. We ourselves find it extraordinary that anthropologists should invariably describe primitive man as crafty, brutal, cruel, savage, vicious. These Cro-Magnon men were fine in stature and noble in mind, and, if they could have lived in such surroundings as ours with all our advantages and our civilization, we should be to them what the Bushmen are to us—perhaps there would be an even greater distance between us, when we consider how we are the willing slaves to obsolete laws and customs, as well as wealth and caste.

The primitive present-day "stone-age" man found in remote places is neither a noble savage nor a fear-ridden, brutal, degenerate cave-man; but he has primitive manners and habits, naturally, and he is suspicious because this has proved to be a survival factor—one which has been inherited by our own children. Also he is cruel on occasion. Yet he is social and has an organized society with customs, taboos, and a primitive religion; he responds to kindness, to humour, and to generosity; he does not descend to the brutal and degrading practice of hanging criminals by the neck until they are dead. Civilized man has probably developed from a somewhat better stock than these, so our precursors would be of a higher type. All of which bears out our contention that the Cro-Magnon was a finer type than we are. His disappearance is a striking example of how the Intelligence of the individual will succumb to the Intelligence of the environment unless the individual keeps fit and prepares in every way to meet and overcome those influences which tend to destroy him.

Even in those men who preceded the Cro-Magnard, the little brain, the overhanging brows, the undershot jaw, do not necessarily signify cruelty and savagery. Existing anthropoids—lemur, gibbon, orang-utan, chimpanzee—are not cruel and vicious in their lives. Gorillas seem to be, but must it be assumed, therefore, that the gorilla is closer to us than the gibbon and the chimpanzee? Yet, if primitive man was brutal, savage, and cruel, this must be so.

As far back as history goes we find the humanities; in prehistory we find settled peoples, home life, civilization. These must have been many thousands of years in developing, and how could the change have taken place between half-human, cruel, vindictive brutes and these first home-makers? No! We prefer to believe, until some definite evidence proves otherwise, that man developed from some quiet, kindly animal who associated in groups for companionship and protection, but who had plenty of courage and could show fight when attacked, or would attack an enemy to defend his own kind. This is not merely a pleasing fancy; Darwin gives an instance of a great ape running back in the face of rifle fire to rescue a young one who could not escape fast enough. And it may be mentioned that man has ninety-eight characters in common with the chimpanzee, against eighty-seven with the gorilla. Remember also that it was only when man became more civilized that he became more deliberately cruel.

The progress of primitive man when he had emerged from the purely animal stage was rapid compared with his development up to that time, though we are over 500,000 years from primitive man. There was a tremendous speeding up of curiosity and of thought. He discovered the meaning of sex and founded marriage, taboos, and morals as well as many other tribal customs—we stretch our hands down to him through the ages and show him the shackles he thus riveted upon us; we have forgotten or have never been able to discover why he did so, but we are still too near to him, too barbarously minded, to hack them off. But the further progress of man is the subject of anthropology, and here we must leave it.

V

It is due to man's unspecialized and plastic brain, together with its powers of generalization, of discovery, invention, adaptation, that he has attained his commanding position over all other animals and to a large extent over his environment. There is an obvious danger in this. If he neglects his physical nature or runs to excess in any way, the environment will take toll of his negligence and he will be in danger of extinction. He has risen rapidly, magnificently; he may fall as rapidly unless he takes more care about his methods of living than he is doing at present. History is a long tale of the rise and fall of different classes of animals and of the rise, fall and extinction of races and nations; modern man will be no exception unless he uses to advantage the Intelligence he possesses. That he will eventually do so is certain; it is only a question of whether he will begin to use it now or whether he will muddle along through wars, industrial strife, conventional absurdities, unhealthy habits, poverty, disease, for another few thousand years.

The principal limiting natural factor in his survival is the possibility of being unable to adapt his body to changes in the environment; but this is a surmise only, and he may be able to devise artificial methods of meeting with environmental contingencies whereby he will survive indefinitely. The greater danger is in neglecting to ensure the elimination of the artificial conditions under which he is now living, and which are already undermining the constitution of the race and making great inroads in his natural health and vigour. But the knowledge he has of how evolution and development have taken place and how they are likely to act on himself should enable him to keep his body perfectly tuned to a changing environment, either by bodily fitness, by protective coverings, by endeavouring to produce such alterations in himself by chemical and physical means as will enable him to cope with whatever changes occur. In the meantime, his brain, being unspecialized, will adapt itself quickly to increasing knowledge and understanding, and he will no doubt be able to control his organic environment. All this is anticipation; it will be hundreds, perhaps thousands, of years before man takes himself in hand. At present we stumble along clumsily, blindly, stupidly, and not until Intelligence is brought to bear on our problems shall we know how to deal with them properly, and how to do justice to that wonderful life with which we are endowed.

There are certain authoritative statements and teachings concerning the origin of man by special creation which may conveniently be discussed here. According to these statements, the special creation of man must have been due to the interference of some external power—which we have ruled out; but for the moment this will not be emphasized. Man was created whole from the dust of the earth, but it is quite impossible to reconcile this with the anatomy of man; if he was created in this manner and of this material, then dust (whatever that means, but presumably ordinary earth or sand) must have formed all the cells, blood, nerves, and other parts of the body—a suggestion that cannot be considered seriously. Animals, birds, snakes, fish, flies, vegetation, were also specially created; but it is not so clear how and from what they were made. To say " let " an elephant or a fly come into existence is not really constructive; it leaves too much to the imagination. But it must be noted that many of the organisms said to be created in this casual manner are actually of the same general form as man, likenesses being obvious in mammals (especially apes), birds, frogs, fish, which are all vertebrates—a coincidence which cannot be neglected in ascertaining truth. All these were supposedly put under the subjection of man, but a difficulty arises in connection with the fossilized remains of animals, fish, plants, that lived long before man and which he never saw. And there are hundreds of thousands of kinds of beetles and thousands of animals and birds man never saw until recently, as well as many yet to be discovered—all specially created for no purpose so far as man is concerned.

Many animals, insects, and plants are harmful to man, which makes it difficult to understand why these were made. If they were all created in their special forms, why do they change by adjustment to their environment? And how can men produce changed forms of dogs, cats, birds, cows, sheep, horses, trees, plants, etc., from specially created stocks? Is man interfering with the work of special creation? It was the adult man and woman who were created—man first and then the woman from a part of his anatomy—and it is again difficult to understand how these two were able to produce between them from the union of two microscopic cells an offspring organized precisely like the adult form which was created from the dust by an external power. In view of the diversity of other forms of animals, one wonders why the great apes were created so much like man.

At what period did this creation of man take place? Was he similar to present-day man? If so, which—white, black, yellow, red? And were the other-coloured men derived from the one created? Some fossil men are so much like modern man that it would be difficult to say they were not modern men. Did these fossil men exist before created man, or were they derived from him? If the latter, how far back was the creation of the first man?

VI

Difficulties could be multiplied in connection with this assertion of special creation, and there seems to be something unsatisfactory and inconclusive—even meaningless—about it. Unnecessary problems arise which are impossible to solve—problems which are easily accounted for by other methods of origin. But an examination of this doctrine is essential if the truth about man's origin is to be ascertained, and it cannot be casually set aside because it is merely authoritative and without evidence, for if it proves to be untrue, as it undoubtedly is, it shakes the very foundation of such authority and makes other declarations from this source suspect and usually valueless.

We consider it, then, to be more reasonable, more in accordance with the evidence, more probable, more certain, that the primitive stock of present and prehistoric man, fossil man, apes, lemurs, gibbons, derived from still earlier forms. Structure, embryo, bodily development, racial evolution—all bear out this conclusion.

If we examine contemporary animal life we discover many links between the different forms, many similarities that grade into one another so smoothly and gradually that we are compelled to assume there is a connection between them. Although they are so different in their general appearance, form, habits, and methods of life that we can easily separate them into different orders of being—man, elephant, mouse, cat, horse, cow, hare—yet they exhibit likenesses which compel us to place them in definite relations to each other. All these, for instance, are mammals, and—with the exception of man—all quadrupeds, and thus form one great family of animal life which must have arisen from one primitive stock. But each of these orders contains many forms which are so different when compared with one another that we can separate them into groups and sub-groups, and these again into smaller but still distinct kinds, so that one great group comprises many different forms which have one distinctive feature—namely, that each form breeds true to itself. There is discontinuity in continuity. Cats, for instance, comprise lions, tigers, lynxes, pumas, ocelots, jaguars, leopards, wild cats, domestic cats, all breeding true to their kind, yet all cats. It is the same with every great division of the animal kingdom. What reason could there be in specially creating all these different forms of one group? It seems quite nonsensical.

In some groups, especially dogs and pigeons, the Intelligence of man has taken upon itself the function of creator, for he can produce forms that have never appeared, and never can appear, in nature, because if subjected to the impacts of a natural environment they would disappear at once. Yet in the production of these new forms he takes as his guide the principle of evolution, of deriving many forms from the one original stock, so that man's "special creations" depend on evolution.

Besides mammals, there are distinct groups of amphibians, lizards, fishes, birds, insects, crustaceans, worms, and many others to which the foregoing remarks apply; they must all have been derived from primitive and still more primitive stocks. All plants in their enormous variety follow the same principle, and as origins become more and more remote we arrive eventually at those simplest organisms, protozoa, protophyta, protista, which will be mentioned later. As we get nearer and nearer to the origin of life, the possibility of special creation recedes, and as this idea fails all along the line of evolution, reason rejects any suggestion of it applying to the transition between organic and inorganic matter, or to the physical and chemical changes that occur between the elements of which all things are made.

CHAPTER V

CONCLUSIONS

IN Chapter III the development of man's Intelligence was traced back to its primitive source. In Part II of this book an endeavour is made to follow the sequence of changes in the form and structure of matter from its first appearance up to its final form, so far, in man. It is not necessary for our purpose to follow up the development of other existing organisms, but if any organism, or any form of matter, be studied, its development can be traced back in the same manner to that primitive substance from which the whole universe seems to be derived.

Several conclusions are forced upon us while considering these changes, and some of these conclusions are briefly mentioned in this place in order that the reader may appreciate the line of reasoning or argument which has resulted in that particular conception of Intelligence which has arisen out of them.

It appears, then, that the material universe may have developed from a mass of heterogeneous particles as a result of some of these particles moving erratically in relation to the rest of the mass. The cause of this was the Intelligence of the universe putting itself into motion; as all matter thus developed it means that all material substance is Intelligence in motion. The first moving particles we shall call "mitrons," and it is from these that pre-atomic matter seems to have developed.

Environment arises first out of the movement of mitrons because when they move they disturb the surrounding medium, or matrix of the universe, which must react, and so environment occurs. The mitrons also form the environment of each other.

From this movement of mitrons, time and space as we know them are created, which means that time and space have no existence apart from the movement of Intelligence.

There appears to have been perfect harmony before the movement of the mitrons, and this movement produced a disharmony which has increased with the development of inorganic and organic matter. Intelligence has been trying to regain harmony, or to bring about a new sort of harmony, since its first movement began. Perfect harmony is therefore not possible for matter in any form, but an approach can be made towards it by association between Intelligence and man's conscious behaviour.

Incidentally, the condition of the matrix of the universe before the movement of mitrons is almost, if not quite, unthinkable. Perfect harmony is inconceivable—and probably undesirable for human beings as at present constituted because it could not be understood. But this does not rule out a near approach to perfect harmony by the man of the future.

It is found that there is no such thing as a Law of Nature which must be obeyed by one or more forms of matter. All such Laws are based on the degree of regularity of the behaviour of matter; hence they are only Rules of Behaviour, not Laws of Nature, all the " forces " of nature arising from within matter.

The accepted " sun-and-planet " atom does not seem to accord with the logical development of the mitron and its movement, and a wave-like motion of a cubical, tetrahedral, or even octahedral particle is more consistent with this movement.

An endeavour is made to show the stages of development from atom to man. There is difficulty in understanding the development of the highly complex atoms, such as radium and uranium, from the simple hydrogen atom if this development takes place without Intelligence. No atom seems to have one constant weight; hydrogen has three (1, 2, and 3 respectively), krypton has six (78, 80, 82, 83, 84, and 86 respectively). This seems to indicate an intelligent effort to adjust each atom to the conditions of its environment, not a rigid incomprehensible development under Natural Law.

The combinations of different atoms to form molecules is also simpler to understand if it takes place intelligently rather than automatically or by the compulsion of Natural Law. When the complex colloid molecules, which form the basis of protoplasm, are reached, the difficulties of the accepted explanations of their development increase.

The formation of protoplasm from colloid molecules is still a profound mystery which may never be solved, but, if Intelligence is in control of all development, protoplasm must have developed from these molecules in a rational, logical manner. There are certain conditions of primitive pre-organic environment which may have encouraged that combination of inorganic colloids which led to the origin of protoplasm, and these will be mentioned.

A consideration of the most discussed problem of existence—the origin of life—will follow. It will be found that life never had an origin in the usual sense of that term, but that it is a gradual development due to a change in the method of growth of the colloid molecules, this growth exhibiting the phenomena which constitute life.

It is generally accepted that protoplasm is the physical basis of life and that all living organisms have arisen from it, the manifold forms of life being due to a struggle for the maintenance of existence during all evolution, the most competent maintaining their existence and their competence being passed on to their offspring. This survival of the fittest is due to Natural Selection, but we find difficulty in the generally accepted meaning of this term because nature does not select—if it did it would be a living, thinking entity. Natural Selection is but a term for what happens; if a plant or an animal dies before maturity, it is said that Natural Selection has weeded it out, which implies definite action on the part of Natural Selection. But this is not true; the organism has died because of its own inability to maintain its existence under the particular general or local conditions of its surroundings. Natural Selection is like Natural Law, a term for what happens; neither has any influence whatever on life or matter, but as concise descriptive terms for the events they refer to, they are extremely useful.

The development of living forms leads us to consider the relationship between offspring and parents. The brilliant discovery of unit characters by Mendel led to the gene theory, which means that every character possessed by any animal or plant is represented, in the form of a gene, in the fertilized ovum from which it developed. When the male and female germ-cells unite, the genes corresponding to similar parental characters coalesce. In doing so they influence one another; either one is stronger than the other—in which event only the stronger character appears in the mature organism, the weaker character being latent though still present—or the two genes are more or less equal in potency, the mature organism then showing an intermediate form or quality between the two parents in respect of this character. For instance, the character of colour in the seeds of peas may be yellow or green; the yellow one, being "stronger" than the green, appears in the next generation if plants with yellow seeds are crossed with those having green ones. The yellow is called the "dominant," and the green the "recessive," character. There are difficulties in accepting this simple gene theory as a Law of Nature, and, once more, Intelligent control may prove to be a more satisfactory explanation, inasmuch as the ways of development are the ways of Intelligence.

The unique nature of man has already been mentioned, as well as the very extraordinary conditions of the origin and development of the earth and of organic matter. It may well be that no other planet in the whole universe is of a quality able to produce a plastic organism similar to that of man, with such a highly developed brain and with such remarkable probabilities of indefinite expansion.

The senses of man in relation to the brain will be noted, and it will be recognized that he is the product and prey of his nerves, glands, reflexes, while at the same time being under some peculiar control which no physician or psychologist can fathom, a control which repairs injury and regenerates tissue, "the control of mind over body," a control which at the point of death frequently exerts a power latent up to that point, something in the nature of an as yet unknown "crisis hormone" which drags one back to life again.

A consideration of all these phases is essential, for no loophole must be left for the assertion that some power, external to the universe which we know, interferes at any stage in the logical sequences of natural development. Chapters VI to XIV deal with man as an individual and in relation to his social environment as these are our more immediate concerns, while the evidence and arguments upon which the foregoing conclusions have been based are left to Chapters XV to XX (which form Part II of this book), because it would divert the flow of the principal theme if the reader had to turn his attention to the phases, aspects, and problems of the origin and development of nature, from mitron to man, before dwelling on the importance of the relationship between man, his Intelligence, his behaviour, and his problematical future.

CHAPTER VI

THE CHILD

I

It will be readily conceded that the Intelligence of any individual is associated with him throughout life. Now, where does this association begin? Is it at birth? If so, it must arise anew at the birth of every organism, some external agency interfering at that stage. Such interference has already been ruled out, hence the continuity of Intelligence must be maintained during the pre-birth, the embryonic, period. It may be said that development during this period is controlled by some sort of intelligence which is not the same as that of the mature organism; in other words, man's intelligence as we know it is not the same as that which controls the life of the embryo. This suggests that two intelligences are at work in man, one before birth and one after, but for this there is no evidence or justification whatever.

The only possible point of interference is during the union of the germ-cells of the parents; but the Intelligence of the mature organism must pervade every part of it, including the germ-cells. It cannot be assumed that the parental Intelligence ceases to exist when the germ-cells unite, and an entirely new Intelligence comes into being at the very same instant. Hence there is continuity of Intelligence between germ-cell and embryo, embryo and body, body and the germ-cells again, this continuity never being broken, which means that it is racial as well as individual; moreover, it means by inference that this Intelligence reaches back in time to the origin of all things. (How often we shall have to refer to origins in these pages!)

In Chapter XIX the wonderful harmony obtaining between the embryo and its surroundings is described. This same harmony should be found in the mature organism, but obviously this is not the case. The environment of the embryo is one of protection, while that of the fully formed organism necessitates a struggle of one kind or another, active or passive, against external conditions which tend to destroy it. At the same time there are compensations which induce the organism to make a determined effort to maintain its existence. The expression of this determination has led to all existing forms of life, the Intelligence of each form bringing it into sufficient harmony with its immediate surroundings to enable it to attain maturity and to reproduce its type. When this harmony fails the type becomes extinct. So, when all harmony ceases, all types of life will become extinct; but with such an intimate understanding of Intelligence as is now possible, together with the determination to control our own development in accordance with this understanding, we shall approach a harmony whereby the life of mankind on earth may be extended indefinitely, with an ever-increasing appreciation of our good fortune in succeeding to such a glorious inheritance.

When the child is born it is a complete organism, but as yet unfitted to cope with its natural environment unless assisted by its parents, especially its mother. Every organ, muscle, nerve necessary for its whole life is practically complete; all that is needed is continuous growth until its full physical and mental stature is attained. This growth is by expansion or multiplication of its cells. The nerve-cells, however, are complete in organization and number and can only expand; they never divide to produce their kind; therefore if any are destroyed they can never be replaced.

The newly-born child possesses the three-dimensional framework of the brain into which experience has yet to be woven. This framework is not the same for all children; character, grades of receptivity, different degrees of response, are already built into it and form its basic qualities. Intelligence is already in control, the organs all function naturally, and life is care-free. Not until the senses are disturbed or irritated by hunger, thirst, cold, pin-pricks, does " will " express itself—at first almost a reflex action—but the brain is becoming impressed by experiences and the child is becoming alive to its environment by the operation of its senses, nerves, reflexes, cortical neurons, which are all in readiness to deal with external stimuli.

If man is to live his life as perfectly as conditions will allow, the expanding mind of the child must receive far more attention than has been the case up to the present time. The early years of childhood are more impressionable than any that come afterwards, and the foundations of character-development are built during these years.

The Intelligence inherent in the development of the organism from zygote (see page 243) to birth is concentrated on the building of a complete body by cell division (see page 252), the arrangement of the growing structure being moulded into the type, and to some extent the detail, of the parents. In Chapter III it was shown that Intelligence precedes all activities, and this applies to the growth of the embryo. Intelligence is not something outside the organism that picks and chooses and directs as does the manager of a factory; it is within the organism itself, it is the Intelligence of all the organized cells working in harmony as one unit. If this group Intelligence ceases to act, the organism ceases to exist and the parts which compose it separate out, each with its own particular Intelligence, now at a lower stage of organization. Usually when the Intelligence of any organism ceases to act the parts rapidly disperse into parts less and less organized until the atom is reached, this being about the most stable form of substance; but sometimes the dispersing organism arrives at a stage where it may be reincorporated as food into another growing organism—for instance, certain complex colloids may be absorbed into organic growth without further deterioration, though frequently they are split up into simpler forms by the organism which absorbs them.

In the developing organism, the group Intelligence arranges and rearranges the cells, their changing functions, and their locations, and as organization develops so does the Intelligence which controls it, for at every instant the living activity must be carried on, or the organism dies; it cannot carry on by itself as a physico-chemical action, inasmuch as such action would not change with growth—it would only grow without changing, and therefore it could not of itself develop into something more complex than itself. Intelligence, which immediately precedes change, maintains the activity of the organism, and both Intelligence and organism develop almost instantaneously in relation to one another until the child is born. The relation between child and parent is but a phase of this development, and need not detain us.

After birth there is an entirely different state of affairs. Intelligence is now in contact with the Intelligences of other organisms which are also striving to maintain existence, and every Intelligence must contend with antagonisms, frustrations, hindrances, to free development. The organism is intensely individualistic—nothing has the right to exist except itself—it is the most important thing in the whole universe, whether it is a microbe or a man. But it is surrounded by an environment which consists of the Intelligences of earth, air, and sea, and of all the inorganic and organic beings that constitute its world. Not until it is older does the child become aware of its relationship to other living creatures, but its Intelligence at once attempts to adapt itself to its surroundings by responding to stimuli as already mentioned.

The brain at this stage is a clean receptive sheet which begins to be impressed at the moment of birth. The eyes are sensitive to light and are kept tightly closed, indicating that the effect of light is perceived by the brain immediately. Touch is at first appreciated most by the lips, but the manner of being handled, pain, warmth, are rapidly registered in the brain. Sound, taste, smell, quickly follow. These early experiences are the beginning of the long series of impressions on the brain which eventually lead to logical thought, understanding, self-consciousness. At first the child is purely selfish, it is the essential ego, and demands that its needs be immediately satisfied; it is simple, straightforward, amoral, seeking in the most direct way to satisfy its desires regardless of others. Only contact with the environment modifies its behaviour. Experience is at first the only teacher; the fire burns, the light dazzles, the smack hurts, the sugar is sweet, judgment of distance comes only with crawling and touching, knowledge of form and consistency comes by touch. All these eventually become second nature and their origins are forgotten, but the impressions formed in the brain are due to these experiences and may be revived and reinforced by similar experiences or by coming into consciousness by the processes of thought.

II

To understand the importance of the proper training of the child mind, attention may be drawn to the structure of the nerves in the cortex of the brain. A cortical nerve, or " neuron," consists of a cell containing a nucleus, a thin fibre called an " axon," extending from one part of the cell, and a number of shorter fibres called " dendrons " or " dendrites," which extend from another, usually opposite, part of the cell. The end of the axon receives stimuli from the senses or from other nerve-fibres which it transmits to the brain-cell. The cell responds by registering the stimulus and, if necessary, by sending out an impulse through the dendrites to another neuron which conveys it to a muscle, whereupon an appropriate action, depending on the nature of the original stimulus, follows; alternatively, the effect of the stimulus is stored up in the brain-cell as a sense impression for use on a future occasion. The sensation of heat will illustrate this. The hand receives warmth from, say, a fire, and the stimulus of heat is conducted to the cell. If it is too hot for comfort, the cell sends an impulse by way of another neuron to the muscles controlling the movement of the hand, which is removed hastily from the fire; if it is not too hot, no impulse is sent to the muscle, but the sense of warmth is registered in the cell. The sensation of heat has thus made a definite impression on the nerve-cell, and at any future time this experience may be reinforced by similar stimuli or it may act without a fresh stimulus by warning the hand not to get too close to the fire—sight and touch thereby acting in collaboration. But one single cell is too small to effect an urgent response, and such a stimulus affects thousands of axons, all of which transmit it to their respective cells. Stimuli from all the senses act in a somewhat similar manner; the totality of such experiences forms memory, and education is really the accumulation and association of memories.

Now, the axon of the neuron may be just the thin fibre which is part of the actual neuron, or it may be enclosed in a sheath. The cortical neurons (the nerve-cells of the brain) cannot operate at all without their axons being sheathed. But while most of the cortical neurons of the mature man possess them, many axons remain unsheathed until the necessity arises for the sheaths to form. At birth the axons are usually without sheaths, and it is the reception of impulses from the senses that induces them to form. The sheaths protect and nourish the axons and also insulate them from other axons. It is largely by the formation of these sheaths that the child mentality grows, because all the neurons in the adult brain are present at birth. Intelligence depends on the number and nature of the neurons and on the number and nature of the impulses received. This means that the growth of intelligence depends on the senses being stimulated, on the stimuli passing through the axons whereby axon sheaths are formed, by the axon transmitting to the cell the impulses generated by the stimuli, by the cell storing these together with many other impulses, by the association and collaboration of neurons in forming ideas which may affect the operations of the body or which may result in thought. Incidentally, the sheaths are confined to the axons because if they covered the whole cell, the cells would be insulated from one another and no association of neuronic impressions, no thought, could take place. Similarly, the free end of the axon is not sheathed because external stimuli could not pass through the sheath, so none could be received by the brain, and the senses could not function.

What does all this mean? First, the more impulses the brain receives the greater the accumulations of sense impressions and the more the receptive portion of the brain will expand owing to more axons becoming functional; second, the more these impressions represent truth and reality concerning the outer environment, the greater the understanding will become. Impressions received through the senses are usually reliable, but much depends on the accuracy of observation, for if this is not exact, false conclusions can be easily drawn, especially when for any reason these conclusions cannot be referred back to the senses for confirmation. Impressions received directly or indirectly from other persons—one of the greatest sources in civilized life—may range from truth to falsehood, and such impressions are so frequently inaccurate that little or no reliance can be placed on them until they are verified from other sources or by reference to authority. This puts an abnormal tax on the brain, because no clear thinking can take place on any subject until accurate evidence concerning it is first obtained. It is with great difficulty that false impressions can be replaced by others which enable true conclusions to be formed.

Hence, if correct associations and interpretations of sense impressions are to be made, the impressions must themselves be beyond doubt. This is almost impossible, but the nearer they are to truth, the more reliable will be the conclusions based on them; therefore the brain of the child should from the beginning receive impressions which it can assimilate, and these should be of such a nature as to form a steadily growing understanding directed towards the attainment of the highest degree of intelligence. This is a counsel of perfection, but if it is known what is best for the making of a fine intelligence, every effort should be directed to that end in a community which adopts true progress as its ideal. The development of the neurons in the brain of the child is obviously of the greatest importance, but experts in education seem to be entirely ignorant of this.

III

Many schools have been founded with the object of studying the child mind and endeavouring to train it in the way it should go. But this way all too frequently differs with the ideas of those in charge of the different schools. Moreover, the intensive study of the child is usually limited to children of the middle classes. The upper classes have their governesses and tutors, public schools and universities—a stereotyped education which is no concern of anybody. The children of the working classes go to the elementary schools after a somewhat anarchical existence from birth to about five years of age, a word or a blow often sufficing for what training is considered necessary up to that time. In huge classes of forty or fifty they learn reading, writing, and arithmetic, with some history and geography and a few oddments—sometimes all the pupils in the class are taught French *en masse*, or piano-playing! At fourteen or fifteen years of age, after nine or ten years of "education," they leave school with a "whoopee" and life begins. A few take scholarships and go to secondary schools, and, rarely, some attain a university degree. It is the children of the middle classes—those who go to "high" schools and "grammar" schools—who receive the best available education and who respond to it best. But there is urgent need for studying the children of all classes of society in order that the child of poverty may have an opportunity of making good, and the patrician may be worthy of his purple; for childhood is a stage in the cycle of life, and child guidance, training, and education should be along lines which will enable the child to bear the responsibilities of individual and social life with credit.

This study should begin at a very early age, and the trend of the child's character should serve as a guide to its future education, and possible vocation. This study cannot well be made in the home, because parents have neither the necessary knowledge nor the ability to undertake such work; besides being too great a strain on them, as it is quite a specialist's task. Such a study would soon disclose a feature which is at present grossly neglected—namely, the educability of the child. There are scores of thousands of children who can never benefit from ordinary education. They have no learning capacity and their lives are made miserable by being forced to attend school and to suffer the tortures of an education common to all of similar age. They are a drag on the more intelligent pupils and the bane of the teacher's life. But it is obviously not the fault of the child, and if more intelligent interest were shown in the " backward " child by those who are supposed to control education, such children would be dealt with wisely. At present all exceptionally backward children of varying ages are grouped into one class under a teacher who shows aptitude in controlling them and whose life is one long martyrdom. Observations on young children would soon enable a classification of the differing degrees and qualities of mentality to be made which would indicate the sort of education best suited to each class. All this can be done without interfering with home life, but contact with other children is very desirable as early as possible, the best form of discipline being acquired naturally by association with children whose claims to attention are as good and often as vociferous as its own. The budding intelligence of the child will benefit enormously by this study, and the early formation of character arising from it will enable the child to take full advantage of its subsequent education.

The mental progress of the child is stressed here because the expanding mind will more easily understand the Intelligence within it and will more enthusiastically associate itself with its future fulfilment, if education be adjusted to the child's growing mentality.

CHAPTER VII

EDUCATION

The child usually enters school full of eager interest, often suppressed by timidity or the primitive fear of new associations. There is a feeling of anticipation and adventure, and a readiness to retreat. Emotions are very near the surface, but there is always the refuge of home. There is a hunger for agreeable contacts with its fellows, it desires friendship and makes advances to anyone who will respond. The looming tragedy of education is absent while the instincts of companionship and play are in full possession of the child's mentality. It dances out of school with a feeling of joy and relief, and its attention is immediately concentrated on games, social contacts with other children, discussions of childish affairs, differences of opinion in rudimentary values of conduct and fair play. All this is true education, for the child really educates itself in the things that matter, while teaching only forces its mind to dwell for a time on special subjects alien to its desires and often to its nature. Play, conversation, and, above all, freedom, are the expressions of the child's intelligence, and therefore impress the brain far more than any enforced teaching.

But if Intelligence and education be associated, the child comes to a realization of its possibilities far better than by any other method. In most education, however, little attention is paid to Intelligence, to the natural abilities of the child, but endeavours are made to enforce learning and knowledge on an unwilling and resentful personality, which is thus tormented, distorted, and permanently deformed.

Many " methods " have been adopted with the object of teaching children more or less naturally, but nearly all fail in their aim because teaching is rarely co-ordinated with receptivity. To let a child do what it wishes is not the right method; it leads only to wilfulness and an attempt to dominate other children. Frequently it is found that what a child desires is to its own disadvantage because the desire is ephemeral and leads nowhere.

A greater understanding of the receptive condition of the child's mind at any particular period, and the guiding of education in that direction, will enable it to learn without effort, deeper impressions will be made on its brain, and it will be far happier while learning in this manner than it will be by any other sort of work, play, or instruction. It follows that, if children are taught in classes, then children of very different ages should be taught together.

When one observes and reflects on modern educational methods, one is not only astonished but profoundly depressed at the utter lack of vision and the indifference of educational authorities to any sort of progress in science, art, psychology, or in methods of teaching. Any changes now in progress are the result either of criticism by those not directly engaged in education, or of suggestions, unwelcome and ill-received, made by the more enlightened teachers and lecturers. No thought is given to the individual child—it is just a number, and the number is often a cipher—and it is to be "educated" according to its age and not in relation to its ability to learn or its receptive capacity. Rote is the first principle of elementary education. No meanings, no explanations, little individual attention—just age and a task. A waste of time, energy, and expense, as well as being criminal in its infliction of mental slavery on the child.

Age as the determining factor in education should be abandoned without the slightest hesitation and replaced by mental fitness for and appreciation of the particular subject being taught. Any such group may consist of children of various ages, and as most subjects will be taught to children of different ages, there will be no anomaly in older and younger pupils sitting side by side. Present education often means torturing a child by endeavouring to squeeze a quart of knowledge into a pint of brains. It does grievous harm to the mentality of the child, which is reflected in its health and progress, and Intelligence can only with great difficulty bring the mind back to its normal condition—if it has not been too far distorted for complete recovery.

Many an uneducable boy is forced to study subjects beyond the power of his brain to assimilate, and in the process he is lashed by the whips of the teacher's scorn and becomes the butt of the more brainy children while wondering dully why he should be made to suffer this torment. There is born in him a deadly hatred of all learning, knowledge, teachers, and superior intelligences, and if, when he has the power, he eliminates them just as they have eliminated his mentality, who is to blame—him or his " teachers " and those educational authorities who make no attempt to introduce those reforms which are so frequently brought to their notice ?

It follows from this sort of education that acquiring knowledge of social conditions or of science, art, beauty, and even of the most rudimentary subjects becomes repulsive and a state of ignorance is all the pupil yearns for, because it is the only way of escape from these compulsions. It is not altogether the fault of the teachers—it is impossible to teach those who are unteachable—it is the fault of the indiscriminate bundling together of children of one age, many of whom are unteachable, many of whom are bright and keen to learn.

II

The necessity for more reasonable methods of education is so obvious that present methods seem to be deliberate on the part of those in authority in order to keep the people in ignorance and subjection, to prevent them from understanding the manner in which they are being governed, and to play upon their prejudices at election times and during national crises. The resentment created in those who suffer under this treatment, but have enough sense to understand it, is fruitful of dissatisfaction and possible revolution.

It may be said that education has much improved recently and that children are now more content at school than ever before. The latter is true—but anyone who has had to deal with training " school-leavers " in trades and businesses needing even the most elementary knowledge knows full well how education has failed to prepare them for any sort of work requiring intelligent application.

Perhaps one of the most astonishing practices in modern life and culture is that education ceases when the child or youth leaves school. The ordinary school-leaving age is from fourteen to eighteen years, according to the social class of the pupil. These school years are the most impressionable years of life, during which the mind should be trained in those principles it can accept and assimilate.

But real education comes after the school age, for the experiences of young men and women are immeasurably more educative than information taught to them as children; but the authorities wash their hands of them after they have passed or failed their examinations. So when " education " finishes, the youth follows his own Intelligence, his own " bent," but his mind has by that time been so warped that he hates any suggestion of more learning and goes his own way, buffeting and being buffeted about the world in the endeavour to find himself. Is it any wonder that so many of us find life not worth living?

In what is called higher education—that of the universities—there is much improvement. The advances in science originated largely in the universities, and their bases have been broadened since they became open to scholarship pupils from the lower schools. But even here culture and learning often consist of studying obsolete philosophies, dead languages, static humanities. This would not matter except that it is from the graduates of the universities that most of the important officers of State are selected, and with such medieval mentalities at the head of affairs it is no wonder that progress towards true education is so slow, halting, and unintelligent.

Suggestions for real, progressive education cannot be dealt with here; it is too large a subject for our canvas. But a point or two may be hazarded. In the first place, all education should be directed to the progressive development of the intelligence. Then, the selection of teachers should not only be by examination but—what is more important—by the skill in transmitting knowledge and the ability to control children. It is teachers, not examination passers, that are needed for education. Every child should be carefully examined with regard to its capacity for receiving education and placed in that class most suitable for its particular abilities. In some cases the child may prove to be uneducable, and it would be a waste of time and energy, and a torture to the child, to submit it to any sort of education. Yet it may well prove to have ability for learning manual work and later in life may seek eagerly the education which would have ruined its mentality in childhood.

In addition to reading, writing, and observation, the general education should include simple mathematics, especially geometry, which would be the beginning of a training in logic and the use of intelligence; children, as a rule, are definitely logical, and it is surprising how easily they understand subjects that are taught rationally. The subsequent value of these is inestimable, as the child is encouraged to use its reason in all the circumstances of life with little effort and without having formed prejudices which may afterwards lead to misunderstandings. Biology, also, of a simple kind will enable the child to understand the relationship between itself and its living surroundings. Especially it should be taught to think in terms of the general welfare, beginning with that of other children with whom it comes into contact and leading on to the whole people, the State, and the world at large. Towards the end of school instruction the youth should be made to realize his responsibilities to his fellows so that he may be worthy of taking a place in society, and in order that he may understand the meaning of his position, his worth, and his importance in selecting for the control of his country those men of sound integrity and ability who are best equipped and qualified to carry on the work of the State.

He will be trained, of course, along those lines which his " personality study " and his aptitude for any particular kind of manual or mental work have shown to be the most agreeable to him, so that when he leaves school he can at once enter that domestic, commercial, technical, industrial, scientific, or other trade or profession for which he is best fitted. The haphazard conditions which now prevail when the girl or boy leaves school will be replaced by a rationally organized system which will enable the youth when setting out upon the journey of life to take that path which will not only give him the greatest personal satisfaction but will make him a good citizen, one who will always be ready to share the duties and responsibilities of life with his fellows. It should go without saying that in this discussion " him " means " her " also.

Examinations of a kind will always be necessary to test the ability of the youth—and incidentally that of the teacher. But the fear of examinations will quite disappear under rational teaching. The general conduct and ability of a student will be more important than examinations, and if he fails in the latter it will not disqualify him for any post for which he is suited.

III

It is claimed that a man's greatest interest, his life, should be in his work, that the life of the medieval craftsman was the most perfect life, that every man's work should be creative, and that all humanity should endeavour to lead this sort of life. So we find Guilds and Societies preaching this doctrine and endeavouring to discard modern methods of production and to revert to those existing in the Middle Ages. If every man had the ability to choose his craft and the opportunity of practising it, that would be excellent. But never in the history of mankind was there a time when every man was in a position to choose his craft, and never was there a time when men generally could make such a choice. Some men may have been able to do so, but extremely few; the very great majority were never in such a fortunate position. And already we are over half a thousand years from medieval times, quite apart from the very simple truth that most men were never very happy in their crafts, but had to adopt them from force of circumstances—by being the sons of their fathers, or as a means of existence—not because they chose the craft they loved. Life is now on an entirely different basis, and it is better to acknowledge present-day conditions and make the best of them, especially as they are incomparably better in every way than those of the Dark Ages.

When all men have sufficient income for their needs and a surplus for their reasonable wants, and when they have leisure to devote to the things that most interest them, then the level of general intelligence will be raised automatically and all people will take a living eager interest in the meaning of life, in the relationship between the individual and the environment, and especially in progress towards harmony. At present only a very small proportion of mankind can, or desires to, bother with anything beyond maintaining existence. Their little lives are confined to reading lazily the fleeting literature of the moment, eagerly scanning the news-sheets for results of the games and sports they "follow," occasionally visiting the theatre or the cinema, and making an annual visit for a few days to the sea. And then they die—most of them, in all classes, wondering why life has proved so empty and so meaningless.

This will change with better conditions of life, and already progress is going on rapidly. A comparison between the conditions fifty years ago and the present time reveals an advance that is startling, and the increase in the amenities of life and the greater opportunities and pleasures men enjoy are almost too great for them to appreciate. It needs only a true understanding of Intelligence for men to change their attitude towards life. The urge to live will be replaced by the urge for life, and real values will reveal the most desirable things to work for. There will be few men who aim at achieving prosperity for its own sake, for when all men are assured of a decent living with leisure to do the things they desire, prosperity will make no appeal if it needs any effort to attain, because it will be a waste of that life which man experiences only once in all eternity. And who would be fool enough to spend his life in labouring after wealth if he had the certainty of enough? The essential thing is *life*—not fortune, position, power, career—and all other things should be subordinate to that, and all education should be designed to achieve it.

One supremely important feature about Intelligence is that it continues to expand with increasing knowledge, and at any time throughout life, so long as the "open mind" prevails, the brain may be stimulated to new thoughts, may turn to new aspects of knowledge, may attain a wider and deeper understanding of one's life work, may change completely from one opinion to the opposite in accordance with the accurate evaluation of new facts and evidence. This makes the circumstances of each individual life a constant source of new experiences and new delights, of greater tolerances and keener joys, deeper harmonies and, above all, the realization of that supreme Intelligence which is the precursor of all things and which has attained its zenith, so far, in man.

CHAPTER VIII

SEX

I

During the later years of education the child develops into the youth, and life becomes complicated by the physical, mental, and emotional changes corresponding to sexual maturity. Sex, after this maturity, is intimately bound up with almost every detail of life. Next to hunger and thirst it is the most dominant desire of all organisms, and especially so in man because of certain differences which make sex desire continuous instead of being periodical as in most other animals. Moreover, hunger and thirst are individual matters, but sex needs two persons for its consummation, which vastly alters its significance in the life-history of the organism. All our lives are beset by this desire, and those who do not feel its attraction are abnormal; but as they do not usually become parents, this abnormality dies out. The artificial nature of civilized man results in great sexual disturbances, and as sex is closely associated with mental conditions, it looms large in any departure from normality.

For thousands of years sex has been intimately connected with certain religious teachings, from primitive people to the present time. Some of these religions hold that sex has some fundamental quality of sin attached to it and that those persons who are able to carry on without relations with the other sex are to be admired and set up as an example to others. This doctrine is ridiculous, false, and vicious in the extreme, and has resulted in untold misery and vice—vice, inasmuch as sex has been driven underground and has become perverted and given utterly false values in the economy of life. Sex is in itself necessary and desirable, and, as it is essential for the continuation of life and the race, it is fundamentally pure.

The revolt of youth in this connection is not only understandable but is right, its only fault being that, like all such rapid changes in convention, it tends to go too far, and to extremes that are not justified by the nature of sex—sex licence is an even greater error than the assertion that sex is sinful. If the whole theme is studied on its merits, an understanding of the proper relationship between sex and life in general may be arrived at, and man's actions may be safely based on that relationship; he cannot very well go wrong, and he will have all the freedom the normal person can desire.

It may be pointed out that the organism itself has no knowledge of the continuation of the species; it only seeks to rid itself of an irritation. This riddance is accompanied by a keen pleasure, and in the absence of this pleasure no attempt would be made to allay the irritation, which would then persist and become a disease. Thus, though sex is essential to the continuation of the race, its urges are purely physical, and the question of race continuation never arises as a natural accompaniment of these urges.

Now, why is there a sex question—a sex "problem"? First, because sex is a necessity and a fundamental part of man's existence; second, because men and women are more or less immediately conscious of it throughout life; third, because it is the butt of so many taboos, restrictions, denunciations, and conventions that it is thrust into prominence by engagements, blessings, curses, marriages, scandals, divorces. No one can escape it—no one need do so; but how rarely does anyone study it cleanly and sanely!

Sex problems arise largely from the secrecy associated with sex matters, and the harshness and intensity with which all action and speech concerning sex are repressed or rebuked by parents and others in authority over us before or during the development of sex expressions, impulses, and desires. These checks are registered in the brain, and anything to do directly with sex, or associated with it, relating to it, stories about it, bring those repressions to the mind, and the conduct which follows depends on character. They may lead to an endeavour to suppress the thought, to the intensification of sex desire, to the gratification of the sex urge privately or with another, or to furtive reading and thinking about sex.

Sex is one of the fundamental urges and needs of existence, and its repression or relegation to the background of the mind must result in a sex strain which endeavours to find some sort of release. The question of sex being right or wrong does not enter into the matter, any more than the question of whether it is right or wrong to eat, drink, breathe, digest, excrete. What is right or wrong is the extent and manner of its practice.

The development of the child mind is twisted out of shape by the conduct of the warped minds of its elders; mutilated sex ideas are forced on the child and, as the mind is very receptive and sensitive at this stage, it results in all sorts of false ideas concerning sex which later in life frequently lead to disaster in "immoral" conduct, in suppressed urges that seek and obtain relief in strange ways, in the twisting of the mind into the knots of lunacy, even in slaying. And always the free, gracious, beautiful, natural sex impulses and expressions become sicklied o'er with the pale cast of shame and are frequently directed into mean, vulgar, cruel channels.

What is sex? It is the means whereby the race is maintained; without it almost all plant and animal life, with the exception of unicellular organisms, would disappear; therefore it is essential to the race and enters intimately into the life of the individual as an organic necessity. It follows that the sex urge must always be present in any normal person; that this is so is evident in behaviour. About ninety-five per cent. of our songs have sex as their theme; old men preen themselves almost unconsciously in the presence of a pretty girl; almost all men respond emotionally to the smiles or wiles of almost any woman. In this respect we are still animals. A short study of sex in nature would enlighten us greatly and help to a rational understanding of it in its human manifestations.

II

From Chapter VI we know that the union of germ-cells is the object of sex, the reason being that one strain, one pure line, of an organism does not continue to keep living and healthy indefinitely in nature, but eventually dies out. This is remedied by the union of germ-cells from different strains. What the differences consist of is not known, but the union produces a new line with renewed vigour. The line, in the case of unicellular animals such as Paramoecium, may then continue for many generations before another reunion is necessary; in man, a union is necessary each generation. Germ-cells have something different in their composition or structure which prevents them uniting with their immediate kin but which induces them to seek cells of the same kind but of different parentage. They must also have some urge, some inner disturbance, some inequilibrium or disharmony that compels them to seek satisfaction by uniting with other germ-cells (gametes) in order to achieve harmony. This may be a difference in electrical potential, or a chemical or physical inequilibrium, but exactly what it is has not yet been discovered.

The urge to obtain sex equilibrium leads to the body trying out different ways of bringing the germ-cells together, which results in changes in the organism, the different forms resulting from these changes being called male and female respectively. Even in unicellular organisms male and female may be distinguished, and as organisms become more complex, male and female differ greatly in both primary and secondary sex characters.

This necessity for the union of germ-cells is an urge which has led to emotional changes in the higher animals, and especially in man. With growing knowledge of sex in relation to offspring, and sometimes from tribal necessity or expediency, primitive man surrounded and limited sex freedom, expression, and behaviour by customs, conventions, and prohibitions, and the " sex problem " thus originated. This " problem " is still one of the greatest we have to contend with, and the modified customs, conventions, limitations, inhibitions, indicate our closeness to primitive savagery. The efforts to break the shackles of ignorance which our savage ancestors riveted on to sex are frustrated constantly by the conservatism of our rites, taboos, and formalities, which have no meaning whatever in civilized life, while they cause incalculable misery and unhappiness in all classes of society. Young people instinctively rebel against these obsolete survivals, and in so doing often go to the other extreme; but the blame is not theirs, it lies with those primitive-minded men who dominate society and politics, and find in sex something vile, unclean, and secretive—though they themselves do not fail to indulge in it. They refuse to understand that it is not only the necessary means of carrying on the race, but also an urge that is accompanied by what is perhaps the deepest, purest, and most exquisite emotion in the nature of man.

There is no " sex problem " in nature. There is often an antagonism, active or passive, between the males for the possession of the females in order to gratify the sex urge. When an animal makes overtures to its mate which result in sex action, neither the male nor the female connects this with the subsequent offspring. But when men began to note that sex action was followed by the appearance of offspring, the two became associated, and relationships, customs, and taboos arose concerning this action.

The monogamy of pure love reaches heights of harmony and of beauty of spirit, as well as of love, unattainable by those who adopt looser sex relationships. Hence monogamy is the way of Intelligence. But love matches frequently fail to be lasting. Why is this? Because mutual love has a quality of ideality about it which can rarely be maintained in an environment which is in many ways intensely artificial. Mutual love is naturally very common in the adolescent, and often becomes a temporary obsession—an inheritance from our animal ancestors. If circumstances prevent the immediate consummation of passion, as they frequently do, the lapse of time dulls the keen edge of love and other persons enter into one's life who may prove to have counter-attractions which result in the fading out of the previous passion. But if love continues and is consummated by marriage, one enters on the struggle for life embarrassed by the need of maintaining two persons instead of one. This is a matter of no consequence to those in safe positions, but to those in hazardous circumstances the struggle may be grim, and while it needs patience, sympathy, and understanding, as well as love, to retain the harmony of life, it is easy to find excuses for escape which result in jealousies, recriminations, and disaster. In thousands of homes there is a deep misery which remains private because pride upholds the family tradition of harmony, and a common-sense solution will not break down the barriers placed by convention in the way of freedom.

With a little more prosperity, or even economic safety, many such situations would never arise, and this is where the environment all unwittingly tends to destroy harmony; but observe that it is a more or less artificial environment, not a natural one.

The causes of the breakdown of love in the wealthier classes are due to the greater opportunities of freedom and licence that come with greater wealth, and one need waste little sympathy on such misalliances as occur in these classes. For one thing, a great many marriages amongst prosperous people are made with an eye to material advantage, and love is the mask put on to hide this. Hence, real love is much less common than among the middle and poorer classes. Again, orthodox morality is much more lax among the wealthier classes, and this leads to the rapid decline of real love. Either the man neglects the woman or the woman despises the man, so the first pure passion quickly passes and both go their own way. For social reasons they may remain nominally together, but the divorce court is overcrowded with the dissolution of the marriages of the prosperous.

As usual, the middle classes show a good deal of thoughtful common-sense in their marriage relations and a real appreciation of each other, so that love matches are more common and more lasting with them than in any other class.

III

It seems probable that an economic state in which all people are relieved of poverty and destitution would encourage a greater proportion of love marriages which would last throughout life, and the advantages to the community in harmony, in contented homes, in happier children, would be inestimable—to say nothing of the greatest advantage of all, the direction of love and life in the ways of Intelligence. For Intelligence has implanted this fragrant flower of love in the hearts of men, and it is plucked carelessly and without understanding, soon to be cast aside in disdain. The ignorances and fears of primitive man are fostered by laws and customs which encumber this side of our lives; but while primitive man might have had good reasons for his restrictions and taboos, civilized man has none, and it is high time we set aside the dead hand of authority and swept and garnished this temple of our deepest emotions and made it a clean, wholesome, and free place where we may express ourselves without being ashamed.

Over two thousand years ago men and women were legally more free to love, and to break an undesirable link between them when love was dead, than they are to-day. There were free marriages in the Roman Empire which could be dissolved by mutual agreement or by the desire of one party only. Since then we have not only made no progress, but have returned to more primitive rites and tribal customs in our laws and conventions, and these, being unnatural, have driven us back in practice to natural animal ways; between law and practice we live hypocritically and try to make the best of it, but the common misery of married life is the subject of most of the jests and scandals we hear, and sets a crown of thorns upon the beautiful head of love.

There are probably more old wives' tales about sex than about any other subject, and the whispering old wives of both sexes prevent these tales from being exposed to the clean light of day. The subject of abnormal sex behaviour—homosexuality—is always discussed in the shadows. It is condoned by some and condemned by others; it is stated to be evil, to be of no importance, to be a justifiable relief, to need suppression. And some abnormalities are made criminal. Actually, so little is known about the causes of sex perversion that no judgment can be pronounced on it. Scientific investigation is very desirable in order that it may be understood and properly treated. To the normal person the whole subject is disgusting, but that is all the more reason why it should receive attention and, if possible, be remedied. So long as it remains surreptitious it will thrive. It occurs among animals, and so it cannot be said to be a human fault only.

The delay of sex relations in man until long after sex maturity is unnatural and may be partly responsible for sex abnormality. The curse of prudery which has been set upon it prevents any open discussion, and it must be left to the anatomist, the neurologist, and the psychologist to study it and find causes and remedies.

Regarding normal sex relations, let us refer to Intelligence as a guide wherewith to disentangle the net that man has cast about them and try to discover how Intelligence would deal with them. First of all, we must recognize that sex interferes with all our lives from infancy to senility. In man it is fundamentally the same as in other organisms, and all the laws and conventions with which it is hampered are therefore more or less unnatural. Those which are in any sense natural are the primitive taboos which primeval man considered necessary for the protection of the family or the tribe. These became obsolete some 20,000 years ago, but unfortunately they have been crystallized into our modern conventions by the ignorance and conservatism of those in authority who have made no study—indeed, who have put a primitive taboo on the study—of this most important and essential feature of organic existence.

The most obvious thing is to return to nature so far as this is helpful to the harmony Intelligence is seeking. Not to nature because of nature, but because a retracing of our steps seems to be the only way of getting rid of the artificialities that encumber us—somewhat as the psychoanalyst probes into infantile experiences in order to discover and dispel a complex or an obsession. Many of nature's ways may be undesirable or inexpedient or harmful, but we must not hesitate to examine their possibilities for our purpose; we shall at least know what we have to contend with, though a complete return to nature would undoubtedly be too drastic. So we must needs consider questions of nudism, " free love," communal marriage, trial marriage, promiscuity—though, speaking for ourselves, the first reaction to these is to avoid them all; but at least we can consider them.

IV

Nudism, for instance. After we have recovered from the first shock of the suggestion that adult people of both sexes should walk about in each other's presence unclothed, let us ask what harm there is in it. Many tropical tribes live constantly in this condition and no harm, so far as we know, has come of it. Should we " civilized " people suffer if we adopted it? Are we naturally less decent than living primitive peoples? We cannot admit this, hence if we all doffed our clothing we should be at least as decent as these people—that is, our morals would not suffer, so no harm would come of nudity. Our sex response to the nude in picture-galleries bears this out, and the attenuated bathing-dresses which show so much of the figure have not resulted in any rapid degeneration in sex relations. But what would be gained by nudity? It would abolish the secrecy that surrounds the human adult form and furtive Peeping Tom behaviour would cease, while a more natural and rational attitude towards sex would raise the standard of sex behaviour, and vulgarity in this direction would become contemptible. Moreover, nudity would be a great aid to health and to resistance to disease, and although this can be practised in private, there is much greater pleasure in enjoying it with other people. So say the nudists.

Free love—what about that? If we cut out hypocrisy we must acknowledge that free love is and always has been rampant even in puritanical societies. It is considered to be rare because it is not openly recognized, but this is entirely false. What harm has resulted from it? It depends on whether we consider it from the standpoint of Intelligence or of its effect on mankind. In the latter case, it seems to have had no deleterious effect at all, and this is natural, because marriage conventions apply only to humanity, and almost all animal love is free love, or mating for a season, which is the same thing racially. The special diseases appertaining to sex are artificial and do not affect the argument. From the Intelligence point of view, there is much less harmony in free love than in the close union of monogamy; hence free love is not the way to perfect harmony. Incidentally, by free love we mean a free choice of different partners with loyalty to the partner for a period. Monogamy without marriage may be called free love, but this is the most perfect love of all, because it is loyalty to one partner only and is unfettered and free from all compulsions. Intelligence cannot come into its own until man becomes more rational in his sex relations, and a return to free love, by abolishing the conventions that imprison sex, will lead more rapidly to a true monogamy than the continuance of the present marriage conventions with all their hindrances. It goes without saying that free love should never be compulsory as marriage is at present; it is only suggested here that it should be recognized as a normal sex relationship without the disapprobation with which it is usually greeted.

Communal love is, in nature, the most usual sex relationship. In some species of mammals and birds, mating is monogamous for a season; it rarely lasts during the whole of life. In the greater number of species promiscuity is the usual practice. Evidently, then, this is a perfectly natural condition and is in no way harmful to the individual or to the race, and there is no doubt it would apply to man as well as to animals. In principle it is carried on very largely among men and women in the form of prostitution, but the word love cannot be applied to this, and it is a retrogression towards animality, and therefore is not the way of harmony. We may mention here the "degrees of consanguinity" within which persons may not marry; if they do, they commit incest, which is a very horrifying word. But when it is examined it proves to be but another tribal taboo carried into modern life. In nature incest is common and has no deleterious effects. Inbreeding—how much better that sounds—is necessary for the production of new species and for the selection of animals and plants which show points of advantage for the purposes of the breeder. In man, the Pharaohs of Egypt were compelled to marry their sisters in order to keep the royal line pure. No harm comes from inbreeding as a general rule.

In the village of Usuki, Japan, peculiar conditions have resulted in the villagers intermarrying ever since 1605.

This has had no bad results whatever. The children do well at school, the men are good wrestlers, the standard for conscription is always the highest in the district, the birth rate is not affected, crime is rare, there is no serious hereditary disease, there is no colour blindness or insanity, there is no leprosy or syphilis, yet out of 1786 persons—men, women, and children—there are 27 marriages of cousins, and the general constitution of all is excellent. And this has apparently been the case for 335 years.

Again, at one period the celebrated herd of Chillingham wild cattle was reduced to one cow. But it happened to be in calf, and the calf was a bull. There was apparently an Œdipus complex, for from these two a new herd developed with all the characteristics and vigour of the original cattle.

It will be obvious that in order to ensure good results from inbreeding the stock must be sound. When cousins marry and their children are unhealthy it is due to some harmful character in one or both parents. Hence the good or harm which follows from inbreeding has nothing to do with inbreeding as such, but depends on the healthiness of the stocks from which the parents are derived.

How far incest is a purely legal crime is illustrated by the fact that one form of incest—marriage between uncles and nieces or aunts and nephews—is a crime in Britain and a recognized practice in the United States of America; and marriage with a deceased wife's sister was incestuous in Britain until 1907, and thereafter it became quite a legal, moral relationship. This does not concern our argument, but is mentioned to show how society may alter its taboos and conventions when it sees fit to do so, and therefore nudism and free love can equally be accepted when a sufficient number of people demand them.

Trial marriage is a method which would probably prove the most satisfactory. Thousands of marriages result unhappily because of temperamental or physical differences that cannot possibly be anticipated, while many marriages between people jealous of each other before marriage turn out to be quite satisfactory. The common expression, "You have to live with people to know them," is truer of marriage than of any other relationship. Of all human misery, perhaps marital unhappiness is the worst, because it is constant, intimate, and unescapable. True, many people "settle down" after some time, but life has completely lost its savour, and only occasional freedoms make it worth while. It is worse for the woman than the man, because she is tied to the house almost all her days and her resentment finds relief in nagging and a pseudo-jealousy born of envy, not of love.

How far would trial marriage prevent these unhappy relationships? One can only conjecture, because it is not yet condoned by society. Much depends on the spirit with which it is entered upon. If it is only a try-out undertaken lightly and with an intention of breaking away at the least sign of difference, it will prove nothing and is wholly undesirable from the point of view we are advocating, that of the way of harmony. But if two persons are very much in love (and without love no one should ever enter into matrimony), but for any reason are doubtful about the advisability of entering into a contract which cannot be broken except by a good deal of publicity and possible humiliation, then a trial marriage, which would, of course, be legal, is most desirable, and in a great many instances would prove much more satisfactory than ordinary marriage where the bonds chafe incessantly but cannot be broken. Or it would be simpler in every way if all marriages could be reviewed every two or three years and dissolved at the demand of either party to them. Something of this kind has been tried in Russia, with what success is not clearly known, but whether it has been a failure or a success, this Russian experiment cannot be cited, because the circumstances in Russia are very different from those in other countries, and it is only under conditions generally prevailing that a real test could be made.

Another, and perhaps simpler, method, easier of adoption and serving the same purpose, and one of which there would be less disapproval would be to make divorce much easier. A request by one party for a dissolution of marriage should be enough, and there would be no reason to examine and make public whatever motives or unpleasant details led to the request. In hundreds of cases a man or woman after marriage discovers a greater love or passion for some other person—it is so common that it is termed "the *eternal* triangle"—and the possibility of being able to end the first marriage simply and without publicity will lead to a greater happiness—or to less unhappiness—to all concerned, for even the other partner to the marriage, however much he or she suffers, cannot fail to see that parting is better than continuing to live under conditions which are a misery to both. What rational, unprejudiced person will deny this? Such a right to sever the marriage bond would tend in the first place to make married people give greater consideration to each other if any love, affection, or companionship existed between them at all; in the second place, the knowledge that an unpleasant partnership could be brought to an end would make it much more bearable and the dread of lifelong misery would disappear; in the third place, it would facilitate happiness not only in the home but in other affairs of life, and would be a long step towards that harmony which is the aim of Intelligence. Under such a system the position of women and children must be protected. This is not a difficult matter, and, if the separation is not mutual, the person desiring it must compensate the other fully, if this is at all possible. But this is out of our province to deal with here.

CHAPTER IX

PAIN, DISEASE, DEATH

I

THE life of man is intensely artificial, owing partly to the cessation of Natural Selection in its more intensified forms and partly to his control of his environment, and this undermines his natural constitution and renders his body liable to diseases and malformations. He does not understand how to behave, or eat, or to clothe himself, or to take such exercise as will enable him to live a clean healthy life, and his organism is the most diseased of all animals. If we are to live wisely and well we must pay special attention to the body. An imperfect body means an imperfect expression of Intelligence. We should not attempt to play a fine piece of music on an imperfect instrument; even if we were foolish enough to make the attempt we should fail. Man knows what he ought to do—ten thousand years of civilization have taught him that—but he resolutely refuses to do it and prefers to stagger on miserably instead of setting his feet in the ways of common sense.

In organic beings there are interferences which are not, or do not seem to be, a part of any definite sequence of events and which cannot be accounted for by the mere complexity of the organism. The progress of a disease, for instance, does not become gradually greater until a permanent change takes place; it is resisted by something which is not just physical and chemical change. As the organism becomes weaker, or as the disease becomes more pronounced, the effect of this should be to hasten the completion of the disease until the end, death, takes place; this would be the case if the organism were purely physico-chemical. But this does not happen. In almost all diseases—probably without exception, though the disease may result fatally—a time arrives when something new arises within the organism which enables it to exert a strength or a resistance not found in physical, chemical, or mechanical phenomena. A crisis occurs, a battle between the disease and the urge of the organism to maintain its co-ordinated existence; frequently the disease is checked and conquered and the organism is restored to health. The disease can conquer only when this resistance of the organism has been overcome.

Why is it that in illness Intelligence has a better chance of action than in health? Because conscious activity is lessened, which gives Intelligence a greater control over the energies of the body even in the waking state, and this access of power assists the body to recover although the constitution is weakened by the effects of the disease. In addition, the diet of the patient is adjusted to the conditions and is altogether more rational, the antagonisms of the exterior environment are at a minimum, and the mind is not disturbed by outside events. This liberation of mind and body from external inhibition and antagonisms enables Intelligence to concentrate on bringing the body back to health.

Many illnesses would be avoided if men lived naturally and paid more attention to right food, clothing, exercise, and fresh air. The physician is constantly telling us this, but we arrive at the same thing from our particular standpoint, and this conclusion is the more important for us because it is not so much prevention of disease but enabling Intelligence to carry out its work more efficiently by making our bodies as perfect as we possibly can, that is most essential.

Illness and disease are usually accompanied by pain. Pain is one of the most valuable things in the world. To ignore pain is to ignore Intelligence. Pain is necessary for our protection; it is an irritation of the nerves caused by disharmony. It is an axiom that Intelligence would not deliberately do anything to cause injury to itself; if it did so it would be destroying the very thing for which it existed. Therefore its sole aim must be for the good of itself, and it must endeavour by all means in its power to prevent, destroy, or render innocuous anything that attempts to injure it. This applies to the expression of Intelligence as well as to Intelligence itself—that is, to harmonious co-operation of the body with the environment as well as with the body itself. Hence the body must be protected in order both to survive and to respond harmoniously to its environment. One of the means of achieving this is pain.

If pain did not exist we should not know when we had a disease that might destroy us. We could break a leg and wonder why it ceased to bear us; we could destroy our skin and muscles by burning and not understand why they looked so unusual and did not respond to our will; we could gasp for breath without knowing our lungs were failing us; the functions of the body could stop and we should die without knowing the reason. Pain is therefore quite essential to man's well-being; without it, he could not exist. It is a guide to anti-natural conditions which, if ignored, would result in the disease and death of the organism. In nature the organism endeavours to avoid the recurrence of pain; but human beings endeavour to alleviate it rather than to pay attention to the means of preventing it.

Any sort of irritability must take the form of pain if it is to be of any " alarm " value. In animals, pain is eliminated by natural cure or by death; there is no treatment, no medicine, no operation. Life is keen, and only the fit survive; death is always at hand, but in temporary sickness Intelligence has no artificial conditions, or feeble body, or mental anxieties to interfere with its efforts to restore the animal to health. With human beings the whole aspect of life is changed. Pain is eased and death deferred by the physician or surgeon. Man must therefore always expect to be diseased and unfit, because elimination by death is avoided as far as possible. Moreover, as pain is an indication of disease, man must always look forward to pain and discomfort as constant attendants on his existence. Only by a return to a perfectly natural life and the rigid elimination of the unfit, and breeding from the fit, can man ever overcome unnecessary pain and disease, and it will be a long time before he can bring himself to consider such drastic changes.

II

How frequently is the assertion made that mind controls matter! In disease the physician knows how much the mind of the patient aids his recovery; there seems to be no doubt whatever about this. The " mind " must be latent in the brain, ready to be called upon in the emergency of illness, or it must be created by the will for the purpose of toning up the body to meet any special emergency. But will-power is generally at its minimum in a serious illness. Usually it is in such illness that the power of mind over body—which in this instance means " mind over disease "—is most noticeable; apparently it is not called upon to exercise its power in slight ailments! If it were latent in the brain it would appear automatically when emergency occurred and its power would have some ratio to the degree of the emergency; it would not exercise the same power in the common cold as it would in double pneumonia—at least, one would not think so.

The reader will already know what we think about it. This " mind " is nothing but the ever-watchful Intelligence coming into action immediately disease attacks the body. This it does without waiting for the physician, but it is limited by its circumstances; the body may be feeble from continuous neglect; the mind may have anxieties which prevent the full operation of Intelligence; unhealthy surroundings may aid the disease. What the physician does is to clear away these difficulties by special medicines, pure air, giving courage and confidence to the patient. Frequently the patient himself unconsciously helps by realizing that, as he is very ill and like to die, there is no object in worrying about the external troubles that beset him. It is then that Intelligence can use its full influence over the body and the patient has an excellent chance of recovery if the disease is at all subject to its influence; but some diseases are not: many organic diseases and many diseases of the nerves cannot be cured. Senility, also, though it may drag on for many years, can never be turned back—it would be against the interests of the race if it could.

The best form of resistance to disease is to attend to the general health, to avoid excess in anything, to be as much in the open air as possible—or, rather, to endeavour to do these things, because they are by no means always easy. True, everyone knows what to do, and we emphasize it here only because everyone should avail themselves of the Intelligence within them which always acts beneficially and which they themselves can help so greatly.

It must not be inferred from the above that animals never suffer from diseases. In the reptilian age, the dinosaurs suffered from cancer, arthritis, abscesses, inflammation of the bones. Wild animals have caries in their teeth. The tse-tse fly, which causes sleepy sickness, lived eleven million years ago and presumably caused this illness then. But in all such cases any serious disease meant speedy death or rapid recovery, and while Intelligence aids in recovery, it cannot prevent death when sickness weakens the body too much to respond to its efforts.

From the human aspect pain is undoubtedly evil because of the suffering entailed, but much of the evil in the world is of the nature of mental distress and not actual physical pain. When pain signifies an incurable painful disease the sufferer should have the choice of bearing the pain or of euthanasia—a peaceful passing out of life. This goes without saying among rational people. We ought to have charts of pain showing its significance, and then remedies could be ready to hand. Such charts would assist the physician in coming to an accurate diagnosis without delay; at present he must depend chiefly on the experience he obtains from observations on those actually suffering.

It will be noted that the " mystery of pain " is no mystery at all, but a necessity of existence. The assertion that the burden of one person's pain may be borne by another is pure fantasy. That one may obtain mental relief through the sympathy of others, or if one knows he is being prayed for by others—which, again, is sympathy—is undoubted. And suggestion—the power or control of " mind " over body—due either to sympathy or to direct suggestion by a doctor or by a person in whom one trusts, will help in the bearing of pain and will assist the body to recover. But pain must be present to some extent; otherwise both brain and physician would be without guidance, and this painless condition would not be amenable to treatment; death would almost inevitably follow the elimination of pain in disease.

It is possible that in certain diseases, not of organic origin, recovery would follow suggestion, but such cases would be rare; and it is quite possible also that a strong, sincere belief would enable one to appear to recover for a time; but evidence in this connection is suspect because, in the first place, many diseases which have never been properly diagnosed are stated to have been " miraculously cured," and, in the second place, many such " cures " are only of a temporary nature. Cases of permanent healing by prayer, suggestion, sympathy, mental treatment, distant treatment, mystic treatment, alone, are singularly rare when the details of the disease and the cure are subjected to careful scrutiny by competent physicians.

A young man of our acquaintance was engaged to a charming young lady, and on one occasion after he had driven his car a long distance in winter he remarked how cold he was. The lady pointed out that it was only his mortal mind that told him he was cold and that he was not really cold at all, that this affliction of mortal mind was one of the greatest prevailing errors, and that all discomfort, illness, pain, infirmity, was only imaginary; that no one need depend on any form of mortal aid in these fanciful afflictions. She had known persons who threw away their spectacles after wearing them for many years and they were able to see perfectly. The young man asked her why she did not throw away her false teeth—and so his romance died.

III

The response to sympathy and to suggestion is due to the belief of the patient that he is receiving assistance from some source or other, and this mental attitude enables his Intelligence to act free from inhibitions and bring about recovery, if this is at all possible. The dipping in water, hypnotic suggestion, reliance on sympathy or prayer, determination to believe in recovery, even the belief in the evil machinations of mortal mind, orientate the brain towards recovery, and the " miracles of healing " which may follow are performed by Intelligence which takes advantage of this beneficial change in the internal environment.

The removal of fear, or of a neurosis, will sometimes bring such relief to the nervous system that it acts as a tonic to the body, and physical disease may be cured in this manner. As an example of this, a young man was under observation in a London hospital, and while X-ray photographs were being taken he remarked to the radiographer that he was suffering from cancer. The radiographer asked him why he thought so, and he described his symptoms. It was pointed out that these were not cancer symptoms at all and he was told what these symptoms really signified. The man was so impressed and relieved that whatever illness he was suffering from disappeared with the cancer complex.

Again, the relief of tension when a political or family crisis comes to an end is frequently followed by improved physical health. The quotation on p. 307 of a victorious army being able to resist privation better than a defeated one bears this out.

If a curve of pain be drawn the line would be approximately level for a period at the extreme of pain, because we cannot assume that some one person suffered much in excess of all other persons. Thus this line cannot have a " peak," because one person's pain cannot be added to that of another. Pain is not cumulative; it is limited by the irritability of the nervous system, and any peak in the general curve would indicate that some person would have a highly abnormal susceptibility to pain and an abnormal capacity for bearing it. This is impossible, because the organism could not continue to exist under such circumstances—it would die from physical shock or other contingency before pain could much exceed the line of extreme pain in the curve. All the pain in the world, therefore, cannot be greater than the extremity of pain suffered by one person; and it is highly probable that a great many persons would die before that extremity was reached.

Toothache, that " hell of all diseases," is an ideal pain in civilized life. It is symptomatic of disease, but the disease rarely has serious results, and, however excruciating the pain may be, relief can usually be found or the tooth may be extracted painlessly with the least disturbance to the organism as a whole. Even if all the teeth be removed a more or less satisfactory substitute can be provided which fulfils the function of the natural teeth.

The effect of pain is to banish other conscious actions. No matter how absorbed a man may be in the infinities, pain will divert his attention and he will be unable to continue his meditations or his studies. Immediate experience seems to be more important than thoughts of pleasures or of philosophies. Mental pain is a guide to anti-social conditions in our relations both to persons and to society; if ignored, misery and disaster generally follow, whether they relate to home or social or national life.

Cruelty, which means the deliberate infliction of physical or mental pain, is not in Intelligence, but is one of man's abnormalities. The cruel man destroys his own Intelligence inasmuch as he knows he is being cruel, and that knowledge comes as a warning that he is doing wrong to his Intelligence and hence to the world. Animals do not know that any action of theirs is cruel; hence there is no self-accusation, no pride, no shame, no pleasure, in connection with the pain they may inflict on other animals—it is necessary that they should prey on other animals and it is equally necessary that those other animals should feel pain, otherwise they would never attempt to escape and so would become exterminated. It follows that repentance has no place in animal conduct; it is a purely human quality, or, if you like, virtue.

Animals do not know how to inflict pain. Man's knowledge of pain in himself and his observation of pain in others enabled him to understand how it could be inflicted. This led to the deliberate use of pain in order to compel others to comply with his desires and wishes—and so cruelty arose in the world.

To cause pain deliberately is entirely opposed to Intelligence. Anyone who inflicts pain, or encourages its infliction needlessly, is so far out of sympathy with Intelligence that he should be set apart from the rest of humanity and, if a mental examination showed that such action was innate, his offspring and all who were tainted with this frenzy should be sterilized as a precautionary measure. But to destroy such persons with pomp and ceremony is to transfer the frenzy to those who destroy and those who condone the destruction. The offender should be eliminated, but should not know how or when this was to happen, because the necessity for it is not revengeful—that is wholly contemptible—but protective, and is essential for the general welfare. He should not be forced to drink the hemlock, but his food or drink should just send him to sleep—a sleep from which he would never awaken.

IV

Thoughts of pain and disease lead naturally to the thought of death. When we are full of energy, activity, and interest in the affairs of life, the thought of death comes as a shock, as an unpleasant possibility disturbing our aims, our endeavours, our progress. It seems, therefore, to be an evil and an undesirable event, an abrupt, unnecessary termination to our ambitions and our prospects. It is so far removed from our thoughts as a general rule that, while we are in contact with it every day by reading, seeing, or hearing about it, we neglect to consider it in relation to ourselves. Others may die, but we go on.

The necessity for death, however, if mankind is to progress, becomes self-evident when we give even a casual thought to it. It is only the urge to live, without which the race would soon perish, that makes it seem objectionable; but we ought to have no resentment or fear of it; we ought not to consider it an evil in any way.

We do not become concerned about death until we recognize that it means an end to our activities—feeling, speaking, living, thinking—the end of our urge to keep in existence. The animals know nothing of death, and when they endeavour to escape from their enemies they are escaping from fear, from pain; hence their speed, cunning, taking advantage of shelter, climbing trees. But they have never experienced death, so death does not come within their ken.

If all organisms lived for ever there would be no progress, because the earth would be peopled by primitive life and the organism could never have developed beyond the stage of the colloid molecule or chromatin granule, which would exist by absorbing inorganic atoms or molecules and then, by overcrowding, would disintegrate into atoms and molecules again. Even here death is evidently necessary, though the chromatin granule is potentially immortal; but after the primitive organisms had absorbed all the available food, they could only disintegrate.

But, physiologically, death in the primitive organisms is not a necessity. In a one-celled but advanced organism, Paramoecium, the descendants of one individual have been observed for 8,500 generations during thirteen and a half years, and no conjugation occurred. This is equivalent to 250,000 years of human life; though it was observed that rejuvenation took place occasionally by an internal reorganization of the cell itself, a process known as endomixis.

In man, a substance develops in his cells which inhibits their vitality, and this results in the appearances which indicate old age; also the blood plasma itself becomes senescent. In both cases death comes naturally.

Death, then, is a necessary factor in the development of the higher forms of life, the successive generations being linked together by Intelligence, which is more important than life or death, and which may have originated the death of the organism as a necessary means of achieving the greater harmony. It is the inertia of life that induces us to reject the idea of death, but death is seen to be a biological necessity and is bound up with life. It is a great advantage to life; without it, progressive development could not have taken place and such a wonderful and complex organism as man could never have arisen. So we must thank death for what we are, what we are capable of, what we are to become, and for all this glorious life we see around us, and for all that Intelligence has made us. Life seems short, but man's development would perhaps be too slow if the generations were longer, for in that event we should not have developed so fast and so far. And at the end of life we may comfort ourselves with the remark made by a great scientist when dying at the age of 65:

"If I had strength enough to hold a pen, I would write how easy and pleasant a thing it is to die."

Therefore, since life seems short and death an advantage, the more events and experiences we can pack into our individual lives the more satisfactory we shall find them and the more we shall be adding to the benefits of mankind. We need have no fear of death, though we cannot but regret the ending of the great adventure of life. If we recognize that pain and death are two essentials for health and life, we shall understand and appreciate them better, even though it is natural to shrink from them a little when they approach too near to us.

But so far as progress is concerned there is no point whatever in desiring a longer life than at present. When our active mental or progressive or creative energy has fallen below the average, we should willingly make way for younger or more active mentalities if we really desire the progress and welfare of humanity. This is not to say we must cease to live. We can enjoy life enormously and happily in our declining years and can watch eagerly the new researches, discoveries, and inventions, and the new political, industrial, and social developments of younger generations.

And sometimes, after our active life is over, we can linger in our gardens and watch the flowers bloom, we can stroll beside the streams as they flow down to the seas and find music in their rippling, we can observe the rising and the setting of the sun over the hills, and the moon and the stars in the stillness of the night; and the beauty, the wonder, the mystery of life and Intelligence, induce us to give thanks that we have been privileged to live in this glorious universe as human beings, and to welcome with a smile that gallant death which made it possible.

CHAPTER X

GOOD, EVIL, MORALS

To ascertain the truth should be one of the simplest things in the world, but the circumstances of man's artificial environment have made it one of the most difficult. The two principal reasons for this are, first, difference in observation of events and their accompanying conditions, and, second, the different meanings given to words. If observations were always correct and if words always meant exactly the same thing to every man, the obscurantism which accompanies all philosophy, all religion, all politics, all economics, most art, much of science, would be reduced to such an extent that there would be a rapid advance in civilization, in learning, and, probably, in mentality—perhaps even in the brain itself when the enormous advance in the brain since language began is considered. But such a consummation is completely out of the question, and it will be thousands of years before man will straighten out his thoughts and endeavour always to ascertain the truth of things. Here we can deal only with man as he is, and try to understand some of the more evident difficulties which hinder the attempt to find a rational basis of intercommunication of thought and opinion between men and men.

All phenomena are true. If a phenomenon appears for some reason to be untrue the fault lies with the observer and not with the phenomenon. A man says the colour of a wall is red; another says it is blue. More people are asked to give an opinion after examining the wall. Some say it is red; others say it is blue. What may be concluded from this difference of opinion? Only that the receptive sense—in this case the sight—of some of the people is faulty. No one asserts for a moment that the phenomenon itself is wrong, that the colour may be at the same time both red and blue under exactly the same conditions. Untruth, then, lies in the instrument, in the perceiving organ, in the human being, in the interpretation of phenomena, not in the events of the outside world.

This means there is no untruth in the world apart from man's actions, perceptions, and interpretations of his experiences. These affect the world of thought and reasoning, and as in the mental world ideas take the place of phenomena, as one man's ideas may differ from those of every other man, as each man claims to have the right to his own ideas, unanimity on any subject is very difficult, and untruth —not deliberate but formal—is common, with the result that controversy is rife and misunderstandings form the basis of most arguments, most philosophies, most wars.

Modern man passes through a primitive stage in early childhood, but as soon as the child can take notice of anything it ceases to be primitive, to be natural, all its environment being post-natural, artificial. Its food, clothing, shelter, its nursing and upbringing, its tuition and education, its whole environment, are all highly artificial. If the primitive man removed to an entirely different environment he would survive; if modern man removed to such an environment he would die at once unless he could carry with him his artificial means of subsistence.

The human being comes into natural existence with the fertilized ovum and passes out of that existence at birth; but just as the ovum possesses all the qualities of the embryo at birth, so does the embryo possess all the qualities of the mature man. All artificial aids to existence and survival introduce new ways of living, new responses to novel conditions, and entail new adjustments of mind and body which may or may not induce the germ-cells to adapt themselves to this new environment; but, if no adaptation is made, the dangers of the annihilation of the race increase with every increase in the artificiality of the ways of living, unless Intelligence enables man to overcome the threats of extinction by aiding him to counteract the evils occurring in this new sort of environment. Intelligence cannot do this without man's co-operation. In the development of man certain activities have arisen which were at one period or other beneficial—sometimes quite necessary—but which have now served their purpose and have become a deterrent to his further progress because they perpetuate a spiritless conservatism which constantly hinders his attempts to emancipate himself from useless encumbrances. War, revenge, clannishness, patriotism, caste, hunting, shooting, fear (especially of the unknown) are instances. Until he rids himself of these his Intelligence will be under a disadvantage in its efforts to free him from the shackles his heritage has put upon him.

There are two phases of Intelligence which influence life, one being that of the form, or the organism, the other being the combined Intelligences of those things which constitute the environment of any form. Every individual must protect itself against the environment, which thus seems always to be antagonistic to the individual. Not until the full significance of the environment is grasped shall we be able to analyse it and discover our real friends and foes. The things that sting and bite us often prove to be our friends; some of the germs that kill us can be converted into protective agencies; while many of the things we cherish and admire prove ultimately to be our deadly enemies.

As yet we do not fully understand the meaning of existence, either natural or artificial, and until we do so we shall not be able to judge how far Intelligence is helping us. We can say only that inasmuch as it precedes all action, as well as all thought, the wisdom of the world is contained in it. Yet it cannot control environment; it can only adjust the individual to its own limited surroundings, and in this limitation lie those actions and events we call evil. Yet the things that seem evil to us may seem beneficial to other forms of life and to their Intelligences. We may have our blood sucked by an insect; this to us is an unmitigated evil, but to the insect it is an unmitigated joy. In both us and the insect, Intelligence is in control, but if the evil threatens our existence adjustments must be made to counteract it if we are to survive. We must always keep in mind the object of Intelligence, which is to bring about harmony between the form it controls and the environment of that form. All existing things show how far it has succeeded in its efforts.

Man has thus no prerogative of Intelligence. If he adopts manners and habits which threaten his existence, it will not step in to save him from himself, he will just become extinct and the next highest organism will take his place. Man is not really to blame for adopting these habits, because he has not been aware of their dangers. Things which have seemed desirable and easy to obtain have naturally appealed to him and he has done his best to take advantage of them; it has not occurred to him to deny himself of what appear to be the good things of life; he has not known his relationship to Intelligence or suspected that it would be wise to consider the values of life before adopting the easiest ways of living. Now he does know, and it is up to him to co-operate with Intelligence—that is, to act in such a manner *as to ensure his continued progress towards that harmony which will yield him a satisfaction that will make life a* privilege to the individual and an ever-living joy to future generations. Unless he tackles the situation quickly and in the right spirit he will have to pass through many unnecessary tribulations and disasters before the way is clear. At present he is heading for extinction in several ways, and, though that will not matter cosmically, it would be rather a pity when one thinks of the splendid future that lies before him. Yet, just as the noble Cro-Magnon man was swept out of existence by baser tribes, so modern civilization may be swept away, and all the more disastrously and completely because of our greater efficiency in slaughter, our lesser resistance to disease, our excessive breeding from the least intelligent classes, our amazing stupidity in connection with the production and distribution of food and other means of existence, and some other things mentioned previously.

This is not to say we must always peer and pry into any and every new idea, investigation, discovery, invention, mode, or fashion before deciding whether or not it may be to our ultimate advantage; far better to spread wide the nets of experience, to adventure into the unknown, to trim our sails to the winds of chance. Nevertheless we shall be wise if we direct ourselves generally towards an adjustment between maintaining the amenities necessary for our immediate needs and those efforts which must be made whereby to achieve harmony for the whole race of men, if we think this is worth attempting.

II

Let us consider values for a moment. By values we mean the relative advantages and disadvantages of anything to us as human beings. Here a controversy arises at once—how do we distinguish between advantage and disadvantage? This depends much on our attitude to life and death, and on our desire for individual advantage or the advantage of humanity as a whole.

We must choose individual advantage because individuals constitute the race; there may be individuals without a race, there cannot be a race without individuals. In this discussion we consider, as far as we are capable, those things conducive to the real advantage of man, not to any imaginary, fictitious, meretricious, temporary, or superficial advantage. As an example: it would be generally accepted that good fortune is to the individual's advantage.

But the good fortune of one man usually means the ill fortune of some other man; if not, and if all men had good fortune, the word "fortune" would lose its meaning. If ill fortune occurred to some men in consequence of the good fortune of others, then the "good fortuners" would exist in an environment which included ill fortune. As we are entirely dependent on our environment for our welfare, this means that good fortune is eventually to our disadvantage, which is not good for us and is bad for the race. Such good fortune is not truly advantageous to us, and this simple instance may apply to many more important and involved ones.

If we try to evaluate the things which affect us—emotions, sensations, feelings, which are apparently inherent in us—they become largely matters of comparison. Happiness—misery; knowledge—ignorance; love—hate; health—sickness; wealth—poverty; liberty—slavery: all these have definite values in relation to the individual or the race. The desirable factors in these comparisons cannot in themselves be considered to have definite or absolute values; it is only in relation to their opposites that value arises—their advantage or disadvantage in relation to their effect on the welfare of the individual or the race. Indeed, any factor has no existence apart from its opposite, because if there is no contrast, no opposite, it is unmeaning. In some alternatives (soft—hard, fast—slow, hot—cold) it depends entirely on local circumstances whether one or the other is desirable. To a person at the equator cold is desirable; to one at the poles heat is desirable; so that desirability depends on conditions other than the quality itself.

In order to ascertain real values it is necessary to strip from our lives all conventions, customs, amenities, habits, practices, laws, beliefs, faiths, opinions, and anything else that is or seems to be unnatural or artificial, whether it is bad or good. We must get down to naked nature, and then we may be able to determine how far these trimmings are useful or desirable, stupid or foolish. We shall also see whether they are derived from motives having as their basis the good of the tribe, the race, humanity as a whole, or whether they are burdens inflicted upon us by local circumstances which have been generalized, or by those in authority for their own ends and purposes.

The values of concrete things are usually artificial. Nature places no relative value on gold and platinum, on radium, on pearl or diamond. Values in these cases are only human values and their basis is scarcity, or, as in pearls and diamonds, the need for exerting energy in their discovery, or the necessity for expending labour on their refinement from ores as in gold, platinum, and radium, or beauty as in coral, shell, and flower. To nature, relative values in these things are non-existent.

Human values apply to many qualities, and the line of demarcation between what is advantageous and what is disadvantageous is sometimes difficult to draw. Moreover, what is of advantage to humanity is often disadvantageous to other creatures and *vice versa.* But we cannot do other than consider values from the human point of view—it is impossible for us to enter into the mind of an animal, a flower, an insect, a microbe—our Intelligence acts for our welfare, and on many occasions this must be antagonistic to the welfare of other living things.

Pessimism about the end of the world is an instance of false values. If we are so sensitive about an event which is almost infinitely remote, which may never occur, and which we could certainly never be aware of if it did occur, how fearful we ought to be about our own demise, for the span of life is very narrow, and all men must die in a very few years from the time of their birth and never again will their personalities have any place in, or influence on, the universe. Yet we ignore the brevity of individual life and face the perils and the glory of the world boldly and eagerly with never a thought of an ultimate end.

III

Now, there is only harmony and disharmony in the universe. Harmony is the state of being in complete accord with the environment—such harmony as existed before the mitron started on its wonderful adventures, such harmony as Intelligence is ever striving to attain again. Disharmony is the state of being more or less in discord with the environment, and is the state in which everything in the universe finds itself to-day.

But harmony may be approached so closely that disharmony is almost negligible, though humanity as yet is far from that desirable state. In this approach we are helped or hindered by circumstances; those which help us we call "good," those which hinder us we call "evil." But Intelligence is not "good" intrinsically. "Good" is not an abstract quality in the universe, applied especially to the conduct of man. To Intelligence there are no such qualities as " good " and " evil," there are only harmony and disharmony. Similarly, it is neither moral nor immoral, neither sinless nor sinful. These are all interpretations of human conduct invented by men; Intelligence is not concerned with these distinctions.

What, then, do we mean by " good " and " evil " ? That which interferes with our survival, that which we desire to avoid, we call " evil "; that which aids us to survive, that which we welcome, we call " good." We also find on examination that the condition of things we call " evil " cannot be maintained permanently, which encourages us to believe that the terms " good " and " evil " accurately represent conditions of our environment. From experience we again find that disharmony appears to us as " evil " and harmony as " good," and so these words which we have invented for the exchange of ideas all contribute to the general understanding of the state of affairs—good, right, harmony, happiness, are all associated with our survival, while evil, wrong, disharmony, sorrow, are all associated with extinction. As Intelligence is always endeavouring to achieve harmony it must necessarily always be acting for what we call " good," and this is the first principle of existence, from mitron to man.

It is possible to conceive a condition of things where, in order to survive, evil may be in the ascendancy. In such conditions Intelligence would seem to act for evil instead of for good, because survival is more important than good or evil. But there is a contradiction in terms here, inasmuch as, if evil means survival, then that which survives would consider the method of survival to be good. Harmony, then, and not survival, is the true criterion of good and evil; but we find when we examine the effects of good and evil that evil destroys itself, and this brings good, and survival, into line with harmony. Moreover, evil can never be in permanent harmony, even with itself.

Perhaps it would be better to say " good " and " not good," " love " and " not love," " just " and " not just," rather than to contrast these terms with their direct opposites. In such a manner we avoid a positive assertion that such qualities as evil, hate, injustice, are actively opposed to good, to love, and to justice; we have only degrees of these, not opposites.

In order to judge of the real values of qualities, emotions, moral principles, an endeavour should be made to consider man apart from all social and conventional influences. We should try to imagine how his feelings would have developed from birth free from all coercions, threats, teachings, conventions, controls, laws, frustrations, punishments. If these restraining influences could be eliminated we could get down to the clean, naked being and we should be able to compare and appreciate the enormous possibilities of advance in Intelligence and the appalling extent to which the free development of man's mental qualities has been fettered and suppressed by the perpetuation of a false, artificial environment. We should to some extent know how near he is to evil and what actions he would have to take in order to throw off encumbrances which at present restrict him and make the whole world an abiding place of misery and fear instead of a resurgence towards freedom and happiness.

Man has the potentialities, science gives him the means, Intelligence provides the incentives, of a great and rapid progress towards harmony, towards a condition of things which would make life a joyous interlude between the eternities; it is for him to decide whether to take advantage of what is thrust before him, or whether to continue to make our earth a " slough of despond " and to make this gracious temple of Intelligence a hovel of constant fear and morbid doom.

IV

Evil engenders fear, and fear engenders pessimism. Evil is ever contrary to harmony and is most dangerous and insidious when it acts or moves slowly. Primitive fear of the unknown—due to accidents, dreams, disease, tempest, famine, wild animals, cruelty, torture—induced primitive man to create gods which could be propitiated in order to ward off these fears and disasters. The creation of gods means religion, religion means priests, priests mean the devising of rewards and punishments which will appease the gods, and so fear is again engendered, but another kind of fear—the fear of gods, which is worse than the fear of men or of natural phenomena. It is due to these fears and to these gods that the power of evil, of cruelty, of dishonesty, is greater in mankind than in any other animal. It is our misfortune, and still more the misfortune of Intelligence, that we are descended from this kind of primitive man instead of from the Cro-Magnon, the man who drew animals and men upon the sides of his dwelling-places and on the rocks surrounding his habitations, for in them we find no gods, and we like to believe he had no such degenerate fears as those which torment the minds of " civilized " men some 20,000 years after his disappearance.

But this dark picture has a very bright side, for the world of mankind in almost every way is far better now than it has ever been. Progress is spreading rapidly throughout the world, and discontented peoples will inevitably be destroyed if their actions are evil, while they will as inevitably achieve their aims if these are good. Whatever disastrous wars and oppressions occur in the process of arriving at a stable world condition, these are but trifles in the thousands of millions of years behind us and before us, however terrifying they may be to those taking part in them. In almost all nations the people themselves have the power to prevent these disasters, and, if they will not exercise this power, the fault and the consequences of it are theirs. And even in themselves these disasters will eventually bring peace and concord, because the evil in them will kill itself and the sanity of men will rise above the strong-willed but weak-minded policies which bring them about.

We must take courage in the knowledge that the Intelligence of the universe is on the side of good and that in the nature of things it will, in the long run, control the world.

It will be evident that good and evil are largely degrees of conduct. A permanent condition where evil is in the ascendancy cannot continue, and where good and evil exist side by side the balance always turns sooner or later towards good. For evil invariably destroys itself if left alone, and will all the quicker cease to exist where it is in contact with good. Since good is the more satisfactory condition it should be the endeavour of all people to foster and to increase it—that is to say, to raise the general level of good and evil and to eliminate without hesitation the more flagrant evils. But so long as circumstances allow of the possibility of evil it will remain in existence even if latent. That Intelligence acts only for good is well supported by evidence which confirms that profound aphorism : " The wages of sin is death ! "

From the foregoing we may conclude that, whatever the immediate conditions may be, progress towards ultimate good is inevitable, and optimism must be the natural result of our whole theme.

Morals are in the same case as good, evil, and sin. That there is any fundamental morality, a " moral law," in nature is a pure assumption which is not founded on any known fact. As such a " law " does not apply to animals, if it exists it must have been inflicted on mankind somewhere between the animal and human stage, and the questions we have asked before concerning the possibility of interference in evolution by an external power apply also to this gratuitous assumption. There is no morality or immorality in nature—these are conventional terms to express contrasts in those actions and words we consider to be right and wrong. As in good and evil, conduct may be moral at one period or in one place, and the same conduct may be immoral at another period or in another place. Thus there cannot be any sort of " law " attached to it.

Human morals are survivals of primitive practices, preventive or defensive measures adopted to protect something from somebody, or ethical principles such as marriage conventions, theft and lying, honesty and cheating. Some of these principles are fundamentally evil; others are not evil at all. Those which are fundamentally evil are so in the sense that they interfere with harmony. If moral conduct interferes with desires there is a conflict within the mind or body of the person which may result in irritation, bad temper, cruelty, all of which are anti-social and therefore evil. If such moral conduct is false to nature, it leads to a real immorality—a crime against nature. If it interferes with welfare, it eventually results in the death of the organism and so comes into line with what is called evil. Morality which is inconsistent with natural desire many therefore be evil.

A blow on the head or a disturbance in the brain may lead to a beatific vision or a crime; a gland out of order may lead to immorality, to disease, or to the production of a masterpiece. Morality therefore relates actually to conduct which is approved or disapproved, and not to some abstract quality or law or authoritative pronouncement. If there were such a thing as abstract moral law, then accidents and ill-health could never result in immoral conduct, because a law which could be swayed by such casual interferences would be ridiculous.

All actions which are called moral and immoral are the result of the self-conscious acting contrary to Intelligence. If they were acting together, the question of morality and immorality would not arise. In breathing, walking, sleeping, we do not invoke morality. Theft is immoral, but if all goods were held in common there would be nothing to steal; it is only individual possessions that give rise to theft; hence morality such as this is due not to any abstract moral law but to social conditions.

Good is ultimately necessary for survival, as we have already mentioned. Had survival necessitated evil, then morality would have had a basis of evil instead of good, and evil would have been extolled, exalted, and called moral just as good is now. Morality and immorality are the terms applied to those things which convention declares to be good and evil, and they have no independent basis of their own. While conventional morality leads away from reality, it is of the utmost service in directing conduct towards ultimate harmony so long as basic moral principles lead in that direction and apply to the whole human race.

V

Although conventions are usually obstacles to truth and progress, many of the more ancient—what may be called the ingrained—conventions are so well established that to disobey them would be anti-social in so far as such disobedience would injure the conscience of the race, and the whole race would suffer or tend to suffer from such action, even though the suffering or injury may not be a vital one, and it might open the way to more serious and more real injuries.

One such convention is that of marriage within certain degrees of consanguinity. The case of the deceased wife's sister mentioned on p. 69 is an excellent example of evil being turned to good by a legal enactment. The enactment utterly destroyed the principle of " moral law." One day it was "moral law"; the next day it was not; so how could " law " have anything to do with the case? This is an instance of a change in convention doing no injury whatever to the conscience of the nation.

The " sin " of incest, again, did not shock the ancient Egyptians, as we have seen; yet this same " sin," though committed in ignorance, induced Queen Jocasta to destroy herself and Œdipus to put out his own eyes. Obviously there is nothing whatever " basic " about these " laws." The basic factor which determines whether it is a sin to marry one's sister or grandmother is whether by doing so the race is jeopardized. The question of injury to the individual does not arise if the relationship is entered into willingly.

While many accepted conventions may be shown to be absurd, illogical, and erroneous, it would be the height of folly to attempt to make compulsory changes in them. They can be modified or abolished only by the careful consideration and approval of an enlightened people. It would be disastrous to try to force such changes on a reluctant people, and would lead to a relaxation of conduct that would be altogether undesirable. This does not mean that we are in any doubt about our conclusions; it means that all changes in contemporary conduct and morality must be made by the enlightened minority converting so many people to their views that the alterations will be made with the least inconvenience to those concerned. If the proposed changes are fundamentally sound, the majority will soon be convinced that they are to the general advantage.

Alternatively, changes actually practised by the minority and proved to be satisfactory will soon be followed by other people, and, if the changes are not too antagonistic to law, this will rapidly bring about new and true moralities. How quickly, for instance, the change in bathing costumes came about! And it is likely that nudism will make rapid headway when it is found that it means much healthier bodies and cleaner minds.

About 1875, Sundays were intensely miserable to children. No play was allowed and they were compelled to read of, or listen to, the frightful things that were to happen to them after death if they were not good, dutiful, obedient, and so on, because hell would inevitably be their portion. Outside their homes children were cruel, insolent, mischievous, ill-mannered, in spite of these lessons. In 1940, sixty-five years later, such Sunday torture is extremely rare, and children are free to read what they like, do much of what they want, go for walks, visit friends. But what terrible things have happened, what fall from grace has occurred during the weekdays from this lack of contemplating their sins on Sundays? Strange to say, children are better behaved, happier, less troublesome, and altogether improved. This is a change in convention that has come about naturally and has resulted in improved social amenities where children are concerned.

Consider also the change in musical convention. Wagner was at first thought to be quite barbarous, but he is now considered to be a great master. Grieg was weird at first;

now he is commonplace and copied all too often. Brahms was difficult to begin with; now every school-girl uses him as an exercise. Mendelssohn was delightful; now he is rather feeble. Scarlatti was neglected for a century; now he is almost in fashion again. Western music has become separated from Eastern music, which is considered primitive, fluty, and thin. Negro music is sombre and savage, with menacing undertones that affect negroes much more than white men and raise responses which may result in the abandonment of all control of emotion and passion; but it has become common in the dance-hall and the night-club. So easily do conventions change when freed from compulsions.

VI

In order to get the most out of life it is well to form good habits, to think about what one is doing, and to do it in the best way available. This applies to many things—eating, exercise, study, working, sleeping, thinking. It is not necessary to adopt habits in order to live; one can stumble clumsily along through life, finding or making difficulties, and still continue to exist or to avoid death. But, if one gets into the way of regularly doing things to the best advantage they become easy, life itself is easier and fuller. One needs to pay less attention to unessentials after good habits have been formed, and there is less difficulty and uncertainty and much less strain in life.

Harmony and survival being the tests of good and evil, all general conduct should be subject to these. A logical frame of mind is usually best and most satisfactory because on the whole the human mind is a logical instrument. But, while one must endeavour to live logically, the mind, being only one of the factors of the biological survival of a highly developed animal, is not able to adjudicate accurately upon matters which the nature of its development prevents it from understanding.

Man's natural Intelligence is constantly correcting his self-consciousness, but the self-conscious sometimes acts against Intelligence. Charity and mercy, for instance, seem to be very desirable qualities, but they have no place in a world controlled completely by Intelligence. A condition of things where these qualities are considered desirable is one which has been brought about by man's misuse of Intelligence; he has committed some sin against nature, and that good which is the essential feature of his development prompts him to alleviate the distress caused by his sin. Thus we get sin and atonement, sin and forgiveness of sin, quite a false situation. It is folly to commit a crime and then to set about expiating it; obviously we ought not to have committed the crime, which brings sorrow, pain, disaster, or death to our fellows. This is but one example where conventions and human conduct arising out of them clash with Intelligence and the real progress of man as a rational being. It may be a long time before we are able clearly to distinguish between true and false qualities, but if we attend constantly to the manner in which man has developed it will be seen more and more clearly how life and conduct may be adjusted to the ways of Intelligence.

Why do we here insist so much on getting down to the natural man? Because the artificial development from primitive to present-day man has been accompanied by a vast accumulation of precepts and practices which prevent an understanding and appreciation of true values. It is only by investigating his primitive nature that we can discover how those acquisitions which are to his advantage can be distinguished from those which hinder his future development, and the sooner he sets about this the quicker will his feet tread the ways of harmony.

CHAPTER XI

BELIEF, PHILOSOPHY, IMMORTALITY

I

EXISTENCE has no meaning whatever in the sense of life being created for some special purpose or end. Man has not been created or designed; he has just occurred. He is the product of an attempt to achieve harmony in a constantly changing environment. Other forms of life are produced under similar circumstances, but they have to contend with somewhat different conditions, and in consequence have developed different forms; yet the principle is the same and, as organisms, there is little difference between them. It is only in mentality that man shows a striking advance beyond that of the "lower" animals, though this does not suggest a fundamental difference in mentality; it is because his thinking is not limited to objects perceived by the senses—he can also think *about* those objects. In addition, he is responsive to events and changes in the totality of his environment which not only enable him to survive but which make his brain still more adaptable, more pliable, more able to turn new circumstances to his advantage, more conscious of his surroundings.

The development of his brain and the growth of understanding together with greater ease in obtaining the means of subsistence (which provided leisure to examine why events occur—why a stone falls, why fire is hot, why water flows, why some animals are more powerful than he is) gave him opportunities of inquiring into the meanings of events, of endeavouring to discover causes. The insoluble mystery overshadowing existence has become more and more prominent in his thoughts and has driven him to conclude that there is some definite purpose in existence, and he tries to discover that purpose. He directs his inquiries towards ultimate ends, and, as his judgment can be guided only by his limited reasoning powers and his personal experiences, he assumes that life and the universe are controlled by a mind similar to his own. This mind he endows with exaggerated qualities based upon his own earthly qualities. He realizes, however, that his intelligence cannot account for existence; therefore it must have been created by something or someone, and this must be a person, a mind, because it must think and act. What, then, is this person? He, himself, with his own thoughts, senses, and actions, seems to be the most important reality in the universe, so that which is responsible for existence must have similar thoughts, senses, and actions, for anything devoid of these is not only unthought of, but unthinkable. But how can a higher thing or person be created by something lower than itself? This seems obviously impossible even to the primitive mind, hence the creator must be of the nature of man in thought, sense, and attribute, but on a much grander scale; and inasmuch as this person created the whole universe, he created man also, and, being like a man in everything but magnitude, he therefore created man in his own image.

As man becomes more experienced his knowledge increases, and consequently he endows his creator with greater powers which become more vague with advancing knowledge—becoming, also, detached from the senses, more spiritual, but still with thoughts akin to his own and with behaviour, emotions, passions, based on his own. Indeed, even up to the present day man is incapable of detaching his creator completely from himself, for, although the creator passes through various phases from big man to pure spirit, he still retains enough of the human organism to become the father of human beings, a wholly barbarous conception. Furthermore, the epic of his creator is but a grandiloquent repetition of man's own wars, conquests, personal triumphs, ventures in love and diplomacy.

The doctrine of a single deity simplifies worship but creates difficulties, because this deity must be possessed of all the passions and emotions of man if he is to be a true creator; yet he himself must exercise only the good qualities, leaving the evil ones to be exercised by inferior spirits or by man. These inferior spirits are demons, devils, afrits, djinns, and such, and so a hierarchy of spirits must be introduced.

These deities and devils are more powerful than men, but exist only to help or hinder man in his pilgrimage through this world. They have no object apart from this; there are no heavens and hells except for mankind, and they exist in order to reward him for his virtues and punish him for his sins. So we find man, not his creator, separating out those things he considers to be virtues and vices, which prove to be based on the things that help or hinder his prosperity, which please or annoy him. His feelings often mark his selection of virtue and vice; he relents towards an enemy; this is mercy, and, as it is somewhat rare, it is elevated to a high place in the category of virtues and becomes a mark of exalted character. By contrast, a man can be unmerciful or revengeful, and, although this is commoner than mercy and is generally condoned on grounds of necessity, it is considered to be a vice. In this manner all feelings, emotions, passions, dealings, are listed and thought upon, added to or modified, and eventually there appears a standard of conduct which is pleasing to the creator or to ethical societies. Thus, man in relation to deity has advanced only very little beyond his prehistoric forerunners.

The belief in orthodox deities has been accepted, but rarely studied or examined carefully, by mankind as a whole. To assert that such or such a belief is common or universal is untrue until the evidence for and against it has been brought to the notice of every man and been properly studied and judged by all, without coercion or compulsion. Coercion, in whatever form, is no aid to true belief, no matter how it induces positive statements, or confessions, of faith. And, being evil, it eventually helps to destroy that for which it acts. It goes without saying that compulsion in matters of faith or belief produces no real conversion.

It is curious to find that many of those who study folk-lore and allied subjects, and who point out that primitive taboos, customs, and practices arise out of the limited mentality, irrationality, and ignorance of those inferior types of humanity originating them, are firm believers in modern religions which are based on this primitive folk-lore and which reach even greater extremes of irrationality in their creeds, dogmas, and superstitions. And these are highly intelligent modern men—not those lowly predecessors of ours who strove with nature in the dawn of the world of humanity and in their extremities turned their faces to the skies and sought aid, by prayer and tribute, from the mysterious unknown powers encompassing them.

Man endeavours to find a meaning to the universe because all his experiences consist seemingly of causes and effects, questions and answers, but these experiences are the conditions in which he has not only survived but in which he has evolved into what he is. Thus there may be no meaning to the universe in the sense in which " meaning " is commonly understood. Yet the fact that man exists and does not know how or why he exists implies some sort of meaning, otherwise such an idea—that of meaning—would never have occurred to him; he would still be an animal in thought. By the nature of the human brain, which until recent times owes its development to survival values only, man cannot find that meaning. So he should pay attention to more immediate affairs, to the endeavour to find meanings between things of which he has direct knowledge, for if existence has any meaning at all, this seems to be the best way of approach, the way of truth. To imagine fantastic causes of the universe leads away from truth; it is only along the lines of rational thought that any ultimate truth may eventually be discovered, not by imagining things which have no foundation in fact.

Anything untrue is harmful in varying degrees. Even if it apparently does no immediate positive harm it should be avoided, because, if condoned, it will appear that untruth does not matter, and thereby greater and more harmful untruths are readily overlooked. Untruth is inevitably harmful in the long run if persisted in, though it is sometimes difficult to follow the usual standards of truth because of the conventions and coercions in our environment. Though any accepted truth may not be the whole truth, it may be sufficient for human understanding, welfare, and progress; yet the whole truth is found to be much more satisfying when it is discovered. Instance the discovery that the earth goes round the sun; until that discovery man was in no way disadvantaged in his environment or his understanding, but the discovery was of enormous importance in making clear many things that had never been rightly understood, and it thrust back his anthropomorphic deities to a more remote abiding-place beyond the stars.

Does truth evolve as do body and mind? Do new realities arise as existing ones are discovered and interpreted? Are new realities created as man's intelligence develops? If not, truth and reality are permanent—eternal and infinite—and this is not consistent with an ever-changing universe. If we consider the evolution of development of one form of matter or life into another, we find a new reality; this indicates that realities arise from some simpler form or forms of reality, and this is consistent with the principle of evolution. They are only changes in the kaleidoscope of primitive things, and thus have nothing substantially new in them, nothing apart from already existing primitive basic things; yet they are new realities, new truths.

The more we investigate nature the more we find complexities arising out of simplicity. It must therefore be presumed that a fundamental simplicity lies at the base of all phenomena, and complexities are caused by the continuous and increasing contactings, co-ordinations, combinations of less complex events. New realities arise out of these events, and so all realities have a simple origin and evolve just as does organic matter. This reality which takes the form of a tree did not at one time exist; this language which we find so useful, so essential for existence, is a recent invention.

It has been stated that the physical world outside ourselves is the embodiment of our perceptions and interpretations, which means that our mind creates environment. But, though the ultimate reality of the world may be something very different from our present understanding of it, the world is to us a true reality according to our knowledge of it; its ultimate reality, if such there be, cannot concern us in any way whatever in our everyday lives. Our thoughts are concerned with facts and their relations; without facts we can have no thoughts—not even abstract thoughts or thoughts about abstract things. Phenomena are perceived only by means of the senses. They are not *in* the senses; the thing we see is not in our eyes; the thing we touch is not in our fingers; they are outside the senses. This being so, the reality of things is outside the senses, though this reality is appreciated by the brain. But the more the intimate structure of things is investigated, the more appearance is converted into reality, the more our knowledge expands. Even phenomena which are so remote from our lives that we never feel the effect of them become common knowledge and are accepted as realities. Instance yet again the earth revolving round the sun and the invisible waves operating our wireless receivers.

To understand the fundamental basis of existence, however, it is necessary to accept the principle of ultimate reality, and this acceptance reacts profoundly on life because it enables us to place true values on behaviour. For if by bringing reality nearer to us we find that we ourselves must create our own heaven on earth because no other heaven can exist, then this is a very definite guide to our relations with our neighbours and to our ways of living. This also points the way to our thinking. "I find certain teachings very satisfying," says one. That is very pleasant, but if these teachings are merely fanciful with no basis of fact or truth, what is their value? Individual satisfaction, if it leads to no coercion, intimidation, or oppression, is quite a good thing, but the whole of humanity is of more importance than the individual and personal satisfaction with something which is untrue.

II

It may well be that a very high form of Intelligence can develop independently of speech, writing, or of the senses, and even of the brain and of thought. Many of the things which now appear to be essential to man are late developments: aeroplanes, telephones, wireless receivers, railways, steamships, high explosives. The Greeks had a high mentality without these things, and we may reasonably assume that the Greeks, Egyptians, and Sumerians were possessed of many things which seemed essential to them but which to still earlier races of high mentality were not necessary. Thus many things which seem essential to high human development are only the conveniences of civilization, and a very high degree of mentality may be attained without them.

It may be straining the analogy considerably to assume that there may be mentality to some extent in the gaseous envelope of the sun, but man tends to be of opinion that all mentality, all power of understanding, must be his sort of understanding, and such an opinion is without real foundation and also puts a limit to the power of Intelligence generally. We have not only no warrant for this, but it is probably wrong—considering the fact that we are only developed from the primitive substance of a remote insignificant planet in an obscure corner of one of several million island universes.

The very vibrations that surround us and have produced us may be intelligent to a higher degree than ourselves in their own particular way. It is well to keep in mind, therefore, that our human earthly Intelligence is only one form of the greater Intelligence which has developed to protect us in our particular earthly environment. Yet for reasons we have mentioned it is reasonably probable that our Intelligence is the highest form in the whole universe because of the peculiar conditions under which it has developed. The tragedy of man is that ease of living has sapped his will and desire to understand the relationship between life and himself and his environment. But it is a tragedy that may yet be averted if this relationship can be brought home to him.

When it is realized that Intelligence is the basic influence of the world, it will also be realized that the world may be converted to harmony, which means the disappearance of all that interferes with the progress towards harmony—the elimination of crime, greed, poverty, mean thinking, brutality, and such-like things, by removing their causes—and we shall then direct our efforts to this end.

Is there such a thing in the world as purpose, or a definite aim or end? If so, why was it necessary to create or evolve the countless extinct and existing different forms of life? If man has a pre-arranged destiny he could have developed without the necessity for the production or creation of great reptiles, huge molluscs, ammonites, whales, mammoths, as well as millions of species of smaller and microscopic organisms. (It seems hardly necessary for the development of mankind that 300,000 different kinds of beetles should be produced.) The only living forms needed were those in the direct line of man's ancestry together with those necessary for his sustenance and progress. Are all those extinct organisms, and organic beings now living which have no relation to or effect on man's progress and welfare, just the amusements or whims of a creator, or are they futile experiments, or manifold aberrations of organic chemistry? Or are they just as much expressions of a universal Intelligence as is man himself or any other form of matter?

Whatever purpose or aim life may seem to have has gradually become noticeable owing to the development of Intelligence, of consciousness, and of self-consciousness. But Intelligence does not know the end. The whole universe is compounded of forms of Intelligence, each striving to maintain an equilibrium that constantly tends to be disturbed by the striving of other forms to maintain their own equilibrium, and during the changes necessary for this maintenance many adjustments must be made: old forms disappear, new forms arise, and the universe shows new aspects and new environments. The changes are inevitably in the direction of greater complexity, and the changing forms which each takes on in order to survive are also more complex. This increasing complexity is called progress, because a return to a former primitive condition would not enable the organism to meet the exigencies of new surroundings, new antagonisms; hence retrogressive forms would not survive. Degeneration certainly takes place—for example, in the sea cucumber and the hermit crab—but this is not a return to a previous form (it has never passed through a degenerate adult form such as it becomes), but a development onwards to a form similar to simpler forms of life, yet well fitted to survive.

To pre-scientific man life was a passing state between birth and eternal life. As he behaved during this brief phase so would he earn a place in heaven or hell, and his place in heaven might be deferred for a longer or shorter time in an expiatory condition, which meant that unless he was quite beyond the pale he would eventually attain the goal. But, since the dawn of science, life has become directly associated with nature as a part of nature, while eternal life, or even an existence immediately after earthly life has ended, has become vague, elusive, evanescent, and to many people wholly fantastic and impossible as well as undesirable.

Intelligence, we must keep in mind, has no future purpose or end in view. It exists, as everything in the world exists, in the present only. Though its ultimate object may be to achieve perfect harmony, its immediate object is to maintain existence, and development of all kinds—individual, sexual, racial, social, mental—is to that end. Compare this Intelligence with whatever else you think you believe, and consider without prejudice which is the more probable, which corresponds best to the evidence, which will quickest lead to a more perfect world, which has the greater certainty of bringing harmony into this life of ours—the only life we shall ever experience as men.

III

All abstract philosophies originate in the minds of men. How did they arise in their minds? How otherwise than by thinking? And how can a man think of anything unless he has some physical or mental experience? Abstract thought means putting together concrete experiences and endeavouring to find a meaning in them which is not immediately apparent. If they cannot be accounted for simply, and by reference to immediate experience or fact, some mental endeavour is made to account for them in order to satisfy one's curiosity, to bring equilibrium into the mind which has been disturbed by these experiences, or to account for them in some rational manner whereby mental irritation is allayed.

Incidentally, it is pertinent to inquire whether a person who was quite without experiences of any kind could possibly think about anything. The very basis of thought would be absent, and it is quite inconceivable that such a person could even exist. But if experience is necessary for thought, any philosophy based on ideas and imagination which have no experience to support them would seem to be valueless. It confuses clear thinking when chimera is brought in to explain certain events or thoughts which cannot immediately be accounted for by rational explanation. Such events or thoughts should be recorded and set aside until more evidence is available, and in the meantime one may keep an open mind concerning them.

Almost all philosophers base their arguments on some opinion they hold or some notion they conceive. If these are analysed they are rarely found to have any meaning apart from behaviour and judgments on behaviour. Philosophy simply means an endeavour to fit everything into an individual pattern of thought and experience. The scientist, the tramp, the working girl, the politician, the society woman, the craftsman, each—with or without knowing it—has his or her philosophy, definite or indefinite, clear or dull; it is the weaving of experience, thought, action into the web of life—usually summed up tersely in the words : " That's what I think ! " But is such a philosophy always reliable, satisfactory, or true ?

A person is what his brains and temperament make him, but any philosophy ought to be equally significant to any brain; otherwise, if the quality of a man's brain determines philosophy, there should be thousands of conflicting philosophies, and this is surely the anarchy, or the negation, of philosophy.

The chief object of philosophy is to discover ultimate reality. It arrives at its conclusions through the medium of ideas in which the senses have little part, yet its " ideas " and " universals " are based on facts observed by the senses and its reasoning depends on such facts. It claims—indeed, it has—a high place in thinking and reasoning, but it exhibits a tendency to scorn the thought and intelligence of the common man. It is therefore interesting and amusing to observe that its mistakes and blunders are notorious, being constantly rectified by science—not necessarily with intention—as science advances. Metaphysical controversy is a clear indication of the differences between philosophers who, if their conclusions are based on sound premises, should always be in agreement, at any rate with regard to principles. Yet we find one philosopher claiming that every metaphysical problem finds its solution or the key to its solution in his philosophy, in which case the door is closed to all other philosophies; and another refuses to accept certain evidence because it does not agree with his philosophy, which means that his philosophy is perfect and facts which confute it are false, though facts cannot be false.

It seems that the philosopher asserts his " values " without any real attempt to prove or justify them when they are subject to criticism. They are peculiar to himself, and if other people do not accept them, so much the worse for other people. They sometimes run contrary to ordinary meanings of words, of facts, of knowledge of events and phenomena, and when this occurs they are not true as truth is commonly understood, and so may be rejected. As may be expected, philosophers frequently have a personal bias—politics, ideals, religion, science, conduct, behaviour, economics, morals—and endeavour to prove by their arguments that their opinions are the right and proper ones for human progress. The whole body of philosophy built on such arbitrary values is of little use to mankind. It is simply the outcome of different types of brain following out selected lines of thought, and in its application to the affairs of men it is limited by both the type of brain and the subject selected.

When philosophy departs from the scientific method and begins to make assumptions it becomes suspect, because so often these assumptions have proved false or valueless with the advance of knowledge—and in this they link up with seers and revealers. Scientific prophecy is of much more value than philosophical assumption; that is why science progresses steadily and surely, and why all philosophies are ephemeral and temporary. If all the sciences were linked into a coherent whole this would be extremely valuable for the true understanding of nature and for the progress of all knowledge; but it would not be philosophy—it would be organic science.

The introduction of idea and imagination to account for facts and experiences which are not immediately understandable has been the method of almost all past philosophies, and even of some new ones. The future love of knowledge will pursue different ways and adopt different methods: interpretations will become simpler, more available to the average mind, and will bring satisfaction to countless numbers of people who are at present wholly uninterested in this most important and significant expression of man's reflective thought.

IV

Faith is the firm conviction of a belief. Men may believe anything and have perfect faith in that belief, and no one can deny it to them, no matter how contrary it is to experience. We cannot instruct anyone not to have faith—such instruction would be meaningless; we cannot compel anyone to have faith—it is a fixed condition of the mind, and only death can end it.

How, then, does faith affect the welfare or progress of mankind? If faith is in something which is accepted as true, and which any sane, unprejudiced person will examine and accept, it is of benefit. If it is in something personal to the believer but detrimental to the race, if it is in something which cannot be demonstrated to all men and which men do not accept, then it is a delusion and a danger. Belief and faith are of no value to others unless they are supported by incontrovertible evidence. It is curious that while faith and belief have such a high place in morality, people are so negligent about the basis of their beliefs.

Consider carefully the most abstruse philosophies that have ever been formulated, and it will be found they are based on the knowledge and experience of the material environment. All idea, fantasy, imagination, revelation, spirit phenomena, that accompany philosophy are derived from material facts and experiences. Nothing new that can be examined and adjudicated upon has ever been discovered by such means in spite of all the assertions of faith and belief.

If faith and belief were based on irrefragible truth they would become the common experience of all men, but frequently they are not, and they bring satisfaction only to the believing person; they are of no value to anyone else. Nevertheless, we are not entitled to say that belief and faith will never have any value for mankind as a whole. We know all too little of the real nature of existence to come to such an arbitrary conclusion, especially as the belief and faith of men of science in their work, their investigations, and the future possibilities of the truth in things are the mainspring of their lives. All we can say is that only such beliefs and faiths as are based on facts and deductions from facts which will bear the inspection of all rational men are of any value to mankind, for knowledge qualifies all beliefs.

The mystic is one who applies his vivid imagination to fanciful dreams, sleeping or waking, and believes them to be real experiences received while in his mystic condition. He prophesies what is to happen according to his interpretations of his visions. They refer almost always to another life after earthly death, which is largely concerned with rewards and punishments.

These dreams, visions, interpretations, and prophecies have no basis of truth and are of no real service whatever to mankind. They may pass a pleasant hour if there is in them sufficient poetry and beauty to make them worthy of attention, or they may turn one's thoughts away from the practical world to a world of the future where men may lead happier lives; but that future must be on this earth if it is to be realizable. To transport the future of man to the high heavens where he may lead the life of the blessed sounds pretty, but it is nonsensical prettiness, and may be harmful in removing endeavour from this life and replacing it with a belief in some sort of external aid which almost invariably fails in moments and crises when it is most needed.

The mystic, the seer, the prophet, the medium, the visionary, the revealer, the astrologer, are all harmless so long as other people are not compelled by force, coercion, or intimidation to take notice of them. No one can deny their experiences; but to assert they are true for all men as well as for themselves is very dangerous, because in almost all cases their assertions will not bear examination by the light of truth—and falsehood, however sincere, is a thing to be avoided. If such persons obtain positions of authority, or if they can influence authority, it results in the suppression of truth and in oppression and anti-social conduct, since no contrary assertion is permitted and none can be made without danger to welfare, freedom, or even life. Such men stand for the inversion of truth.

Exaltation is a feature of seership, prophecy, revelation, inspiration. Some of the most inspired poems have been written during an abnormal state of mind, sometimes due to the action of drugs or stimulants. Inspiration may thus be induced by such artificial means as alcohol, opium, cocaine, heroin. One wonders how much of divinity is hidden in coal-tar derivatives. And the mystic is frequently a word-magician, clothing his fanciful predictions in vestments of verbosity which are called revelations.

Why are these mysticisms, these seeings of visions, the prerogative of certain people, generally obsessed by a single idea? What is at the back of mysticism? If it is only some sort of gift bestowed on mystics and their satellites, what good is it, what value has it, for ordinary men?

The ecstasy of the visionary, the poet, the artist, the mystic, may be of supreme importance or value to himself and may teach him wonderful lessons and arouse deep emotions or encourage him to perform noble deeds, but it is useless to others until his ecstasy is put into words or into such a form as will appeal to others. But this translation into words and forms tends to chill or dull the fine frenzy of his dreams, and they can never appeal to others with the same effect, the same result, he has himself experienced. An examination of his explanations leaves one cold, and little help or reflected pleasure can be found in them because they do not apply to one's own experiences, difficulties, and problems.

If they could describe something different from any earthly experience which at the same time would stand the rigid investigation of truth and could be experienced by all men, then reliance could be placed on this mode of gaining knowledge and experience. At present any earnest inquiry into the methods and results of mysticism is usually met with vague claims to "power" which is supposed to be denied to common people—and the common people often accept these claims with wonder and awe.

We are asked to deprive ourselves of our only means of judgment—our reason—when considering this subject, and to believe assertions for which there is no evidence and which are only impressionistic descriptions of a world similar to our own.

It is not that we refuse to accept the idea of an existence like ours but refined of all its grossness; yet what is offered to us is not only utterly devoid of evidence but necessitates a world like ours, an environment like ours, with all its limitations and indecencies, even if refined. Prophecy has no place in development, and to select what is considered to be the best of this life and project it into another place is meaningless and foolish, and appeals only to the thoughtless, the ignorant, or the dull, though many people find it an easy means of obtaining a livelihood.

We are driven to the conclusion that the "evidence" of the prophets is no evidence at all. Their only power is that of influencing their followers, whose degree of intelligence is a great factor in the success of their predictions. Suppose a prophet gave out that a planet or some sort of place existed between the earth and the moon, or the sun, and said he intended to go there after the death of his earthly body and live happily for all eternity. What would be thought of him ? Would he not be considered to be mentally unstable or deficient ? Yet this is what presumably sane persons are teaching. They may place this Paradise or Summerland a little farther away, outside the Solar System, but that makes no difference. Unless it is outside the universe altogether, or unless it is all around us in another state, both of which are wholly incredible, this abiding place of immortality and eternity has no existence and any hope or belief in it is fatuous.

It may be that some peculiar quality of the mind transcends the usual limitations of time and space and is able to observe events which will take place in the future. Before accepting such a notion the evidence will need to be very strong—much stronger than ordinary scientific evidence, because the latter can always be tested, while the former could not be accepted until a considerable number of predictions had been fulfilled with complete accuracy and without any failures. The only evidence which would be entirely satisfactory would be the accurate prediction by all people of all future events. This, at present, seems remote; and if it came about life would not be worth living.

In connection with mysticism and other-worldliness it must be kept in mind that seers, revealers, prophets, and such are people like ourselves who nevertheless claim to be inspired. What is inspiration ? It cannot be from within, because that would be entirely contrary to the idea of inspiration, which means some message from or some contact with something divine—that is, something outside the mind. By what right or authority do men say that such inspirations have any truth in them ? The only test is whether they seem to be reasonable; man's own mind is thus the test of the truth of inspiration. If a man hears a voice bearing a wondrous message from the beyond we listen eagerly. If it tells of a world far away where there is no more pain, where all the sorrows of the world have disappeared, where life is everlasting, where the meek such as ourselves get their due reward, we say he is inspired; if it tells of a moon made of green cheese we are a little inclined to doubt his inspiration. It all comes down to our power of discriminating between what is false and what is true—to whether the evidence for those intimidating, depressing, ghostly religions of death which have afflicted mankind for something like 20,000 years will bear investigation.

V

The idea of a future life in another sphere and the survival of the human personality after physical death has been of the greatest importance since man began to look about him and realize that he was alive. It is asserted that the body survives, or that the mind, the personality, the spirit, survive. Anciently, it was all four, for even primitive man, if he was anything like the lowest types of men now living, believed that man survived in the exact form in which he lived; also, the Ancient Egyptians held this belief so strongly that they placed in the tomb of the dead man all that he needed when he was alive, because it was thought his existence, even his physical body, would pass without a break into the after-life. It is not necessary to discuss ancestor-worship and other ideas held by many peoples about the control of this life by the dead. It is only the possibilities of survival that are interesting here.

If there is survival, do all people survive or only some of them? Now, it is impossible to understand survival if only some persons survive, because this implies selection of those who are to survive. It may be asserted that only the "good" survive and the "wicked" do not. But all people are good and wicked in some degree, and it does not seem possible that only the good part of the personality should survive while the wicked part failed to do so—it would be a somewhat excessive degree of schizophrenia, the splitting of the personality. To overcome this objection it has been taught that the personality survives but does not enter into the full future life until the wicked part of it has been eradicated, or the sins committed in earthly life have been expiated—a supposition which is but a feeble makeshift.

It would be more reasonable to assume that all people survived, rather than that some sort of selection took place, because the latter presumes a selector who is capable of selecting those who deserve to survive. Here again there is a middle way, inasmuch as some people believe there actually is a selector and the selection has nothing to do with personal conduct on earth: the selector just selects, and those not selected must put up with the consequences, whatever these may be.

There is the further notion that the wicked survive but do not go to the same place as the good. These confused ideas induce us to conclude that, if there is any survival at all, then all persons survive. But this must include the idiot, the moron, the sadist, the murderer, the slanderer, the gossip, the thief, the liar, the drunkard, as well as the good.

If human beings survive, do animals survive or not? If not, where is the dividing line between a human being who survives and an animal which does not? (We need not consider those persons who positively refuse to survive unless their favourite dog survives with them.) There must have been some interference from an external power at some stage between men and animals which enabled or permitted men to survive. Where was this stage? Was it where man branched off from the common ancestor of himself and the great apes? If so, then all brute men, cave men, primitive men both extant and extinct, have survived and are now living in a spiritual state with those who have but recently passed over. If survival has been permitted more recently, it is difficult to determine when, for if we say it occurred when the Egyptians, or the Sumerians, or the Chinese became civilized, we find that primitive civilizations antedated them by hundreds of thousands of years, according to recent archæological discoveries. If we hold that animals survive as well as mankind, this must include all living things—whales, elephants, tigers, dogs, cats, mice, lice, worms, leeches, birds of paradise, vultures, toads, blowflies. . . . And if all men and all animal life survive, then all the individuals that ever existed are still surviving. It is curious to imagine what they are all doing and the conditions of their existence. A trilobite which lived and died 100,000,000 years ago and whose shell is now an underground fossil must be fulfilling some purpose in the after-life and has been doing so for those 100,000,000 years. We ourselves find it too much of an effort to grasp this, as well as the spirit life of all the microbes that have passed over.

Do inorganic compounds survive their material existence? If not, where is the dividing line between the survival of animal forms and the non-survival of the inorganic matter of which they are composed? Even if modern man alone survives it can be only the survival of the spiritual form of the chemicals of which he is made.

It is usually asserted that only man's spirit or his personality survives, but, if this be so, in what mental condition do babies and centenarians survive? Are babies always mentally babies, for ever inarticulate, just crying and crawling for all eternity? Are centenarians always mentally centenarians, with faded memories and mumbling speech, for ever and ever? Or do they grow up or grow down as the case may be and survive in a condition corresponding to that of a human being in the prime of life? The latter condition is one actually suggested by Spiritualists. But mentality is the result of experiences in our earthly, material, progressive environment, and there are no such experiences after death; so in the cases of children and old people some experiences must be added and some taken away if the mid condition of life represents that which survives, and no information is forthcoming about how these alterations are made.

It is asserted also that spirits enter the human organism at birth, and it is these that survive. This is transmigration, and introduces another state of imaginary existence where the spirit persists from the eternity of the past to the eternity of the future, from before the world began until after it ends, never changing, never progressing, entering the body of the ape-man or the genius by chance or selection, gaining nothing, losing nothing.

Assuming that the spirit becomes levelled up from the infant and down from the infirm to one average level, then the surviving personality is not the same as the earthly personality, and any question of rewards or punishments cannot arise; this whole subject is fraught with difficulties.

The idea of a future life originated when human beings were well advanced in civilization. Can it be said that they began to survive when this idea originated? If so, were all men doomed to non-survival before that time and doomed to survival after that time? Man evolved owing to the urge to keep alive. This meant a constant change in form and constitution whereby to contend with the conditions of a changing environment; without these changes he could not have been what he is, he would have been exterminated and his brain could not have developed to its present stage. Thus the surviving human personality would be essentially a product of earthly conditions.

Survival means one of two things: either the present stage of man's mentality will be stationary in the future life and will ever remain so, or if mentality continues to develop it must be under conditions that have induced it to develop on earth—namely, an urge to maintain an existence in an environment which is more or less antagonistic. His spirit life will cease if he cannot adjust himself to the conditions of that environment, which must also be changing.

But a consideration of the mentally defective man who survives inclines one to think that mentality will be stationary because he must survive either as a mental defect or, alternatively, his mentality is brought to a normal standard, whatever that standard is in the after-life. In the former event, he is an imbecile for all eternity, which no one will admit, as it is neither just nor possible; in the latter event his mentality is completely changed when he passes over. How this change is effected is impossible to understand, but undoubtedly the individual would not have the same personality as the one who lived on earth. And if the mental defect is changed mentally, this must apply to everyone else in some measure, and it must be assumed that all persons are reconditioned to conform to the survival standard of intelligence, which means that earthly experiences are utterly pointless, and whatever effect they have on character is of no consequence in and after passing over. All mentality has been transmuted to the survival standard, which would thus seem to be on one dead level.

If mentality is not thus levelled out, then there must be grades of existence in the future life corresponding to man's earthly mentality at different periods of evolution. The surviving personalities must consist of all kinds of men from the ape-man to modern man, and as there appears to be no distinction between men after survival—there are no classes or castes—these must be associated together. But one rather suspects there will be groupings of those with somewhat similar mental qualities. The Cro-Magnons, the Greeks, the Italians of the Renaissance might form a group; modern scientists and some of the Greek and Arab engineers, astronomers, and mathematicians would meet on common ground; the Mongols, Vandals, Goths, Slavs, Huns with their modern representatives would find mutual interests; those earlier men whose descendants form the basic fabric of humanity—hewers of wood and drawers of water—would continue to hob-nob together; the ape-men would glance sideways at one another and pick and scratch in happy abandon. The man of the future will have a place of his own because, generally, he will be of higher mentality than ourselves. And all such groups will be static for ever and ever. . . .

Such a condition of affairs is so far-fetched that it may be dismissed as incomprehensible (no doubt even those who consider a future life possible will agree), and we must turn to the second alternative—namely, that mental development takes place in the future life on somewhat similar lines to those of our earth. Here we come to a dead end. Physical man changes only in accordance with changes in environment; spiritual man can change only in a changing spiritual environment. We cannot imagine a spiritual environment substantially different from our earthly one, because this would mean imagining something we have never experienced and which there might be some difficulty in demonstrating.

A spirit must be the spiritual replica of the man. If not, then it is something different, it is not the human personality transferred to the spirit world, and so the human personality comes to an end. If it is such a replica, the spirit environment must also be the spiritual replica of the human environment if any spiritual change necessary for the development of the spirit personality is to take place; it cannot be a new sort of environment, because this would mean a new sort of spirit. Change means the adaptation of the organism to changes in the environment; but such change takes place not in the individual organism but by heredity in a succession of organisms; in the spirit world, however, the spirit organism never dies—it lives for ever, and as there is no marriage in the hereafter, spirits do not have offspring through which adaptation to change could come about. Hence the dead end, and the contention of a progressive mental development in the spiritual world cannot be maintained.

Who would one's associates be in that future life? They can be only those one has met on earth. In heaven no man would know his own great-grandfather unless and until he was introduced to him. For how could a person's great-grandparents know him, since he was unborn when they died? Perhaps everyone will know everyone else there, or, as already suggested, it may be that people of similar character soon form harmonious groups. But unless man's character changes in the passing over, the shadow of the idiot, the moron, and the criminal clouds the fair face of heaven.

But why all these imaginings and spurious beliefs about a future life? What does it all amount to? Simply that no one really desires heaven. What they desire is a continuous existence in which constant change occurs, with pauses at the more pleasant places until they are tired. Spiritual life, then, is not spiritual at all—it is only a desire for the continuance of a very material state of affairs.

VI

History shows that man has never been aided by any power external to himself. Statements and assertions about the help received individually or collectively from external sources will not bear inspection, and are but individual appreciations of benefits bestowed on us by other human beings or by local conditions and circumstances which are falsely attributed to something beyond man himself. Sometimes, indeed, we feel there is something near to us, something that is closely interested in us and in all our doings, something that will bear with us in our transgressions and will if necessary punish us as we deserve, but that the punishment will not be beyond our bearing, some friend who will remain our friend through all eternity. We feel that just on the other side of death knowledge will come to us and we shall understand, that we shall find rest and peace. We seem to glimpse here and there another possible universe, more attractive, more wonderful, more refined than that we now inhabit. These feelings are the most effective stock-in-trade of priestcraft, though they are but a reaction to the stresses and strains of ill-conditioned life, the disappointments, illnesses, frustrations, futilities of it. They could not arise in a world of harmony; all such emotions and yearnings would be satisfied in well living our lives here on earth—the only one we can ever know as individuals. We already have within us the power to achieve that peace, rest, and harmony we so earnestly pray for, easily to be found if we go the right way about seeking it; and we cannot escape from the difficulties we have created for ourselves here merely by longing and dreaming about an unreal and non-existent place hereafter.

Even if another state, another universe, another different sort of existence does await us after death, undoubtedly the best and quickest way of reaching it, of being worthy of it, is by acting in accordance with the Intelligence within us; for, if there *is* something beyond, this is its method of expression here on earth. Many people, in their desire for future happiness, may see visions of paradise, may imagine nobly, may believe humbly, may beat their wings against the stars in the hope of beholding divinity, but all these great enchantments of the world will avail them nothing. Life, heaven, Intelligence, is all about us, or of us, now and always, and that sublime existence beyond the stars which is so earnestly imagined is this one, our own, and it is we who must refine it into the perfection we desire and which, since we imagine it, we are capable of, if we collaborate with Intelligence in our efforts to create it. Obviously, the nearest and most important part of our environment consists of our fellow men, and if we aim diligently to co-operate in every way with each other, the common tragedies of life will rapidly fade out and we shall see how foolish and unnecessary most of them have been.

Some people of small mentality or little courage may be afraid of examining any criticisms of a future life. But this is childish. If the truth shows that we have been following a false idea of our own making must we go on believing in this idea for the sake of custom, convention, or sentiment? Or is it not better to set it aside and make way for the truth, just as false idols and images and creeds are set aside when they have outlived their uses? Any fear in this connection is not the fear of an avenging deity but only the shrinking from the threats and coercions of false authorities and advisers, or from what other people think—very earthly and rather contemptible fears.

Again, the idea of a future life appears to be irrational, meaningless, and unnecessary; therefore it is incumbent on those who hold this idea, or make assertions about a future life, to show they have reason for both idea and assertions, for it is not enough to assert these things without well-founded reasons. The implications of this idea are so vast that it should be studied with the greatest scientific accuracy, and until incontrovertible evidence has been obtained for it, the idea of a future life should be held unproven. If all the thought, energy, and wealth devoted to this idea were applied to the effort of bringing about harmony on earth, we should attain heaven very much more rapidly in our immediate lives and we should have a much better basis from which to study that of the future. But this will never be attained by flinging away the powers we possess of considering, reasoning upon, and judging the evidence concerning what, to many people, is the most important guiding factor in life.

The idea of immortality does not originate outside the brain but by the evolution of ideas beginning with savage beliefs and ending with creeds. We must be careful to analyse the effects of these on mankind. Immortality is a fiction of men's minds, which are very mortal. Every man has his own particular idea of what it means, every man's opinion differing from that of every other man when it is discussed. The general idea of the spirit-world varies considerably with different peoples; the Nirvana of Buddhism, the Paradise of the Moslems, the Valhalla of the Vikings, the Happy Hunting Grounds of the Red Indians, the Elysium of the Greeks, the Heaven of the Jews, the Summerland of the Spiritualists, the Spirals and Spheres of the Theosophists, are examples—and all, very obviously, of the earth, earthy!

If there is heaven and immortality, surely there can be but one heaven and one immortality, and the foregoing are but the extravaganzas of earthly experiences, and the desires arising out of them. To most men the abstract idea of immortality becomes untenable when they try to imagine what it must be like. They are driven to the conclusion that life and conduct in a future world are based on an indefinite continuation of the happier conditions of their own human experiences, not on any immortality that continues for ever and for ever in one abstract state of existence. It is not a real belief in immortality at all, but human desire translated into a profession of belief in immortality, that has had such an effect on mankind. One must understand the evolution and anatomy of human personality before one can say it is possible for it to live eternally, and also one must imagine a suitable environment in which it can survive.

When people think of heaven they think about it just as they think about a care-free holiday. But immediately they try to imagine a continuous existence in that heaven they put the thought aside with some such remark as: "Oh, it will be all right!" In other words, some one unspecified will see to it that they are not bored—and they hasten to talk of their earthly affairs. All ideas, abstract and otherwise, are based only on the evidence of the senses, and it is obviously impossible that they could be based on anything else. All our senses are purely utilitarian, and the assertion that this world is preparatory to another one with wholly different conditions of existence is grotesque. The future of man on this earth is the real immortality and the one we should prepare for our posterity.

VII

The Spiritualist goes so far as to say that he can get into touch with human beings who have lived on earth and who now carry on an existence independently of earthly bonds, yet who are aware of the affairs of earth and who can communicate with us through living persons who are sensitive to their "vibrations." The communications received, strange as they sometimes are, do not induce us to place much confidence in either their authenticity or their wisdom; they seem to have neglected their opportunities greatly considering the importance of the relationships between their two existences.

What advance has Spiritualism made since the days of Saul? The Witch of Endor gave him information such as that often given by modern mediums. Had Spiritualism been true it would have made such progress during the last 3,000 years that by this time it would be an established means of obtaining information about a state of existence which would profoundly modify our earthly lives. It seems therefore that Spiritualism may be put in the same category as astrology, sooth-saying, necromancy, predictions, oracles, omens, sorcery, magic. The belief in these is due to statements occasionally becoming verified, and if one chance statement in a hundred comes true, the ninety-nine false ones are ignored and the reputation of the predictor is ensured. Again, all predictions and oracles are made in such vague terms that they can be twisted to mean many things—sometimes the exact opposite of each other. A little common sense will show the fallacy of all such predictions.

But Spiritualism has many branches, and a denial of all these is unscientific until science has made an exhaustive investigation into its most evident manifestations. The seeing of "ghosts" is such a comparatively common event that to dismiss as falsehoods the statements of all those who have had such experiences is taking an unscientific and illogical attitude. "Table turning" undoubtedly occurs. "Automatic writing" is by no means uncommon, and results obtained by the "planchette" are sometimes strange, though not necessarily true. "Trickery!" says the scientist, and he puts "water divining" in the same galley. But when we stand by our little stream of water, 2,000 gallons a day, flowing from beneath the solid rock twenty-four feet below the surface, we wonder—because we saw the twig move in the "diviner's" hand which encouraged us to dig and blast through that twenty-four feet and which eventually resulted in central heating, a bathing-pool holding several thousand gallons, and half-a-dozen ponds. A very profitable trick.

The production of "ectoplasm," messages received from the dead through "mediums," the rattling of tambourines, the translation of "apports," introduce elements which make one impatient with the whole subject, and when the scientist is engaged on research into the wonderful phenomena of nature —with results he can test in his laboratories and can repeat by experiments whenever necessary—it seems a waste of life to pay any attention to these trivial, obscure, and so frequently fraudulent, phenomena. But there is an important side to it that is worthy of attention, and the way of approach is not to test out the phenomena produced by the professional Spiritualist, who is so often a charlatan, but to investigate any experiences of the scientists themselves that seem to be in any way abnormal. Many people never have such experiences, but those who have would find great interest in studying them.

The subject is of supreme importance to our theme because, if the survival of the individual human personality can be proved, our *principle of the Intelligent control of the development* of the universe from mitron to man and thence to all futurity is without foundation. Yet such authentic evidence as there is indicates the possibility of some sort of communication between one brain and another under exceptional —perhaps abnormal—circumstances; some influence, vibrational or electrical or other, which puts one brain in tune with another for a short or long period of time. There are electrical discharges through the air by means of conductors, and so it may be possible that mental discharges can be transmitted and received by "psychic" transmitters and receivers. Every one of us may be efferent, afferent, or both, to use a nerve simile, to some extent, but, if there is such a system of vibrations, undoubtedly some persons would be more responsive to them than others, and some genuine psychics may be such persons. //

Let us remember that the matrix within which the universe lies embedded consists of a very refined substance. From it all matter, inorganic and organic, has derived, and it would not seem miraculous if one brain could communicate with another by vibrations through this matrix, somewhat as energy, electricity, light pass through it. If this should prove to be the case, it opens up an enormous field of scientific research, one that would be more personal than anything yet imagined, and one which would help profoundly towards an understanding of that Intelligence we are endeavouring to demonstrate. But the claim that such communications can be received from persons no longer living is to confuse the issue, because this would introduce that external interference into the affairs of the universe for which there is no evidence whatever and which is utterly without warrant.

If the subject of a spirit life has been dwelt upon somewhat at length, it is because such an idea not only has no basis of fact, but is in direct contradiction to the principle of Intelligence. For considerably over 10,000 years the idea of a future existence has been preached and enforced by every sort of mental and physical compulsion, yet it is now discredited more than ever before, especially by those who place a higher value on truth than on tradition. It does not follow that because all these generations of men have believed or professed to believe in a future existence that it is true—on such reasoning we should still believe that the sun travelled round the earth; and it is only because of these despotic compulsions that the idea still prevails so largely. It is being rapidly discarded by thoughtful people—those who lead the progress of the world—and is treated indifferently by millions of thoughtless people who give some sort of lip service to it, or whose innate conservatism will not as yet permit them to reject it. A belief in ourselves and a determination to put the truth in the forefront of our lives—in thought, word, and deed—will quickly replace this idea by a belief in the man of the future who will turn this good earth of ours into a far better abiding-place than all the fanciful and mutually exclusive paradises of men's dreaming.

CHAPTER XII

MAN AND HIS INTELLIGENCE

I

EVERY organism is a distinct individual, but Intelligence links men together in ways as yet dimly discerned in the phenomena of telepathy and hypnotism. When these methods of communication are clearly comprehended, another kind of language will develop which will have incomparably greater possibilities than the one we now possess—it will be the calculus to the simple arithmetic of our present lives—and man will make an enormous advance in knowledge and understanding. We may then arrive at a real " crowd " psychology as immediate and perfect as the wheeling of a flight of birds or a swarm of midges.

At present the extraordinary, even uncanny, isolation of the mind seems to cut off completely the possibility of any mental communication, and in this respect man is terribly alone. Wife, husband, child, brother, sister—all are separated by an apparently impassable gulf; only on rare occasions does there seem to be some invisible link between husband and wife when the companionship has been welded together by many years of love and happiness. That is why a free monogamy is here considered to be the finest approach towards a true harmony.

How does Intelligence exert its influence on the individual life? If Intelligence is the basis of the universe, and if it has been in control since the world began, why has the consciousness of man remained in ignorance of it? This is not difficult to understand if one fully realizes that Intelligence has developed in the same manner as that of man and all organic forms. It is not an autocratic dictator creating a world out of nothing which it then guides to a preordained destiny. It knows no more of what man may become than man himself does; it is not the ends that matter but the processes of change in the endeavour to tune the broken melodies of existence to finer harmonies. We do not live in the remote problematical future but in the fullness of our days here, and the expansion of Intelligence is limited by the conditions under which the organism exists.

In every form of existence there is an awareness of action and aim—the aim is constant, but the action varies with form, function, and circumstance. Gradually the consciousness of man has arisen out of the association of the senses and nervous system with primitive desire, emotion, passion, amplified by the unique development of his brain. The power to control his actions, and to some extent his environment, emerges out of this consciousness, and the exercise of this power is called Will. By producing more immediate results, Will has tended to overshadow the more fundamental control of awareness, but it has been present always, and without it Will would be ineffective.

Will, then, is the consciousness of action and thought. It does not act during sleep or unconsciousness; it is the connecting link between conscious thought and bodily action. The decision of thought to order some action of the body, or parts of it, is Will. Awareness is that state of the brain which realizes or understands what is happening either in mind or body at the moment of thinking; it is not apparent during sleep or unconsciousness, though there is an awareness of dreams during sleep which may so impress the brain that it is remembered on awaking.

The Will is concerned chiefly with the senses—that is, with the medium between the nervous system and the external environment. Its function is the immediate restoration of equilibrium or harmony, and as it acts generally in accordance with Intelligence there is naturally no distinct dividing line between voluntary and involuntary action. Will is thus a part of Intelligence and is its servant, just as the senses are. It seems to act on instructions from the brain, and such action is called voluntary.

Involuntary and reflex actions concern the control of bodily functions and of internal and external crises. This control is exercised directly by Intelligence and is immeasurably more powerful, more important, than Will. Will operates only within normal conditions; no effort of the Will can enable one to lift more than a certain weight, but in an emergency, where Will is not operative, one can lift much greater weights. Effort of Will cannot compel more secretions, more hormones, from the glands, but immediately there is organic need, these secretions are forthcoming involuntarily—due to that awareness which is constantly exercised by the organism.

In such a simple case as a bruise, where there is no thought of appealing to Intelligence, it is interesting to observe the sequences in recovery. First, the pain soon disappears, but the effect is seen in the discoloration of the skin, which changes from black to blue and to red until the natural colour is restored. After the pain has ceased we have no control whatever over the repair of the injury, and it continues whether we want it to do so or not. We can watch Intelligence at work as a sort of controlling influence acting quite independently of Will until all visual evidence has vanished. Yet the repair of the tissues still continues until complete harmony, not appreciated by the mind, is established. Will has no part whatever in this series of events.

(It was the healing of a wound that led us to the discovery that not consciousness, Will, mind, desire, had any control whatever over the process of healing, but that it was something quite apart from them—something inherent in the constitution of the body. This something must have greater power than Will or mind, and if it could thus control the action of the nerves and cells, and repair and renew tissues, it must also control other functions and activities of the body. Moreover, the process of healing entailed a sequence of preparation which was obviously intelligent. If such a power resides in the human body it cannot be limited to man only—it must extend to other forms of life, to the very beginnings of life, and thence to matter and to the origins of all things—and, as it is intelligent, well, why not call it Intelligence?)

In some such way Intelligence repairs mental distress. It is said that " time is the great healer," and this is but Intelligence in action, veiling and repairing the natural afflictions of life by new interests, greater understanding, new aspects of living. If life is interpreted in this manner it will be found that, while we cannot but sorrow at the loss of those we love, we turn rather to the joys we have experienced with them and through them than to vain griefs at an end which somewhen must have been inevitable.

The true values of life are health and happiness. Without some security—a word which covers health, happiness, welfare, liberty, some assurance of the necessaries of life, some gratification of our natural desires such as family life—it is difficult to find contentment, and we should endeavour to gain this security by all the means in our power. But to envy others or to covet their possessions or positions is no way to harmony, and those who do so deserve all the discontent and misery they suffer. Most people will say at once that with such security they would be perfectly satisfied; but without Intelligence contentment can never be properly understood or appreciated—always must we be in tune with it if we are to live in harmony.

II

There are two conditions which prevent the ready response of Intelligence to our appeals : one is when the Will tries to dictate to it, the other is disbelief in it. The Will is far less powerful than Intelligence, but unfortunately it endeavours to take command in many situations, and the result is usually unsatisfactory. We cannot order Intelligence to do anything, though there are occasions when it seems to obey orders—namely, when its intention coincides with desire. More frequently we think we are using our Will when actually Intelligence is performing that which we desire. The way of approach is by request; we must say : " Let me do this ! " or " Let me not do that ! "; not : " I *will* do this ! " or " I *will* not do that ! " The latter tends to obstruct the action of Intelligence because there is a clash of endeavour, of interests, or of execution. If we depend on the Will to carry out our desires, then it must be all the time keyed up to its work, but frequently it fails because it does not fully understand what is desired or how to fulfil the desire, and any relaxation of Will results in failure to accomplish what it attempts. On the other hand, if we request Intelligence to carry out a desire we must first make sure that it is a reasonable one, because we know it is useless to ask for the fulfilment of unreasonable ones. After making the request we can dismiss the matter from our minds, and we shall later find that the desire has probably been fulfilled without any strain of mind or Will. Requests would rarely be addressed to Intelligence by those who disbelieve in it; such requests would obviously be meaningless. Nevertheless, should a reasonable request be made, it would probably be fulfilled because Intelligence is indifferent to beliefs, and such a request would postulate some sort of harmony with it.

Prayer, properly understood, would be helpful in co-ordinating the mind with Intelligence, which would ease its task in the endeavour to fulfil any desire leading to a greater harmony of mind and body. In this connection it is found that the deities of all religions usurp Intelligence. There are many deities, but only one universal Intelligence. When men of any religion make an appeal to their deity they offer up a prayer; if it is genuine the effect is to bring about within them an earnest desire for personal association with their deity. As this deity has no existence, and as Intelligence is the guide and controller of the welfare of all men, there is frequently a quick response, for Intelligence knows nothing of deities but is in intimate contact with men's feelings and desires and often responds to them, in which case the deity, of course, gets the credit.

Many requests cannot by their nature be fulfilled. Praying for rain is ludicrous, and is but a savage survival. The prayers for victory by peoples at war are equally stupid, and when both sides worship the same deity it reduces religion to an absurdity, for if their deity answered their prayers, both sides would win! Intelligence knows nothing of States, and prayers concerning Governments and their actions would be meaningless to it, because these are but casual associations of men gathered together for purposes quite outside man's natural development and are beneficial only in so far as they enable all men to achieve a greater harmony in their individual lives. The Government or State which does that has not yet arrived! At present, the peoples of all States in times of war pray for the direct aid of their deities in slaughtering hundreds of thousands of men who are forced into personal combat by conditions entirely beyond their wishes and their control. Intelligence could not understand such monstrous madness nor such prayers. That wars are necessary under present world conditions is unfortunately true, but to pray to deities or to Intelligence for help or to accept responsibility, is another particularly silly savage survival.

III

Many persons may always be able to get into touch with Intelligence, but the great majority can do so only at special times or on favourable occasions or in certain frames of mind. Hence, if one desires to collaborate with it, one should arrange a particular time each day, even if only for a few minutes, in the endeavour to do so, and even the thought that Intelligence is always present—as of course it must be, as it is actually you, yourself—and that it is helping one at all times, brings great satisfaction and relief. The striking difference between this relationship and the attempt to worship a deity who is infinitely remote and of which there is no real evidence soon enables one to appreciate the value of being able to appeal to the Intelligence within one's self. There is no drifting about on a sea of doubt, and the ever-present fear of a deity and the threatened pains and tortures here and hereafter no longer sap one's vitality. It is realized that such fears and threats are all fictitious, all nonsense, trivial and childish; they lead to a desire to shift one's troubles and difficulties on to the shoulders of someone else, a shirking of responsibility, and an endeavour to evade the consequences of one's baser actions by a contemptible and hypocritical repentance. Under Intelligence there is no room for such conduct.

If Intelligence always responded immediately to any request, the organism would be entirely subject to the control of desire, feeling, and Will, and would moreover be a slave to the senses. This would be disastrous to the organism, because the Will, however strong and dominating, is a feeble instrument in determining the permanent welfare of either the individual or the race, and it would be impossible for the organism to carry on if constantly compelled to obey the senses, which evoke emotion, passion, desire, tyranny. The organism would be irreparably damaged by such obedience and could not survive; the Wills of different persons would constantly clash, antagonisms would be the order of the day, the race would rapidly deteriorate.

It follows that Will should be limited to rational control, and whatever requests one desires to make should be reasonable. Response to request may be quick or slow—much depends on its nature, the possibilities of its achievement, the desirability of a quick or a slow response. Often a request is made and is then forgotten; some time later it is found that the request has been carried out. This applies particularly to small inconveniences or irritations that are not serious, but it is very interesting, inasmuch as it demonstrates the constant attention of Intelligence. Another point is that when making a request one almost always adjusts one's actions subconsciously towards its fulfilment; if we make a request for good health we do not eat a supper of tinned salmon, pickles, new bread, and coffee, for we know that such food should be avoided. "If one knowingly eats of anything touched by a weasel the penalty is to sing 110 psalms." An uneasy mental condition will also tend to prevent a response to a request for sleep, though it is at such times that one needs sleep most; it is well to ask that the mental trouble should be allayed first, but this is difficult, because such troubles are due to causes outside the sphere of Intelligence.

The response to a request for the cure of disease depends much on whether the ailment is organic or not. The Intelligence may act explosively, as when a cripple flings away his crutches and walks, but more usually it takes an appreciable time to effect results. There seems to be a period of preparation, and thereafter the response may come slowly or quickly, but it comes steadily, as in a crisis and a slow recovery in the first place, or a quick recovery after the process of repair has begun, in the second. It must be remembered that a request of a serious nature, seriously made, will induce response, and even if not complete the result will be satisfactory, harmony being reached as far as possible under the special conditions, and sooner or later the individual will benefit. But it is of little use making a request that one may never die, for it will readily be realized how foolish it is to ask for impossible things, and this again tends to bring harmony into our relations with Intelligence.

Very often what is called resignation is the result of a subconscious understanding between the mind and Intelligence, but there is no room for pessimism in this understanding. Sadness, regret, suffering there may be, but the knowledge that the difficulties of mankind are almost all due to artificial conditions of life which will eventually be eliminated enables one to dismiss immediate despondency and to be happy one is alive. To say this to a sufferer from a fatal disease, a great bereavement, loss of livelihood, may seem at first sight callous and heartless, for it is difficult to find good in the world when one is poverty-stricken or under the heavy hand of undeserved misfortune; though these are man-made afflictions, that does not lighten the burden. Nor does the knowledge that Intelligence is universal and makes always for ultimate good bring any satisfaction—hunger, pain, mental anxiety, cry out for immediate relief. In spite of all this, disaster and death are lightened by the knowledge that most of these slings and arrows of outrageous fortune are cast by men themselves, not by Intelligence, an understanding of which will lead to a new social organization where such personal disasters are unlikely ever to occur. But to say that afflictions come from a divine source is trifling with tragedy.

The technique of the appeal to Intelligence is but touched upon here, and only the accumulated experience of many people will clarify and amplify the ways of approach. When we attain a more intimate knowledge of it we shall be able to co-operate with it to our great content, for if an external influence could do a tithe of what Intelligence is actually doing during every living moment, such an influence would be hailed by all people as the greatest and most marvellous power in the universe.

CHAPTER XIII

SOCIAL LIFE

I

It will be quite obvious that harmony in social conditions is essential if man is to progress towards a better general welfare, and the greater this harmony the more quickly will that progress come about. A close association between self-consciousness and Intelligence should be the present and urgent aim of all social endeavour—economics, language, education, politics, recreation, leisure, industry. The senses, brain, and intelligence of man have all been linked together in his development, and the closer this union the greater his progress. With the dawn of self-consciousness the process has speeded up enormously—life has existed 1,000,000,000 years; self-conscious about 100,000 years—but self-consciousness has not been aware of Intelligence, and in some respects there has been a drift away from harmony owing to the artificial conditions brought about by civilization. Wearing unnecessary clothes, the use of alcohol, drugs, tobacco, lack of natural exercise, living and working most of the time in artificial shelters, the limitation of freedom, all interfere with natural physical and mental development, not because all these are evil, but because they are used without discretion and tend to impair the stamina of mankind.

Intelligence cannot control social conduct, but if such conduct is advantageous, this leads to greater opportunities for its better expression—that is, to greater harmony. But if it leads in the opposite direction, Intelligence cannot express itself satisfactorily when man gradually deteriorates by his own folly. The general trend is at present definitely towards extinction, but long before that happens *homo intelligensus* will step into the breach and save us. For we believe that if a calamity, such as that which always looms large when dictators and politicians neglect the welfare of the world, swept away most of mankind, the survivors would resume their progress from the point where the calamity overtook them, because there would be sufficient knowledge among them and sufficient vestiges of machinery, scientific apparatus, works of art, together with records and books, found among the fragments, to enable a restart to be made. The horror of the calamity and of the men who were responsible for it would be engraved deeply upon the conscience of mankind, and it is highly probable that the new social conditions would be on sounder lines and more in accordance with Intelligence than are those we are at present observing.

The perennial calamity is that social and economic practices, and a good deal of scientific investigation, are devoid of organized guidance and without definite social aims. They are haphazard, and move along lines of least resistance or along anti-social ways in accordance with the whim of the dictator, the political party, the wealthy industrial or Press magnate. The real good of all the community is never considered; it is only when it coincides with a personal or party advantage that any attention is given to it. The farce of universal franchise clearly indicates the low civic and political intelligence of the "masses."

The social forces, whatever these may be, should be brought into line with the welfare of the whole people, even if this means a total change in some of our most cherished conventions, traditions, and practices. Many conventions are already in a condition of unstable equilibrium, so this would not be difficult. Desire for power on the one hand and desire for safety on the other are the two principal causes of anxiety, dishonesty, anti-social conduct, ruthlessness, lack of sympathy between the classes, disregard of the life and health of the people, political treachery and dishonour. Yet both are artificial. The power of the State or of any person representing it should be controlled by the people in general, while safety is assured to everyone when the State is based on the welfare of all its people.

There is nothing sacrosanct about the State; it exists only for the convenience of those who comprise it. It has no inherent rights or privileges peculiar to itself. It arises primarily out of kingship or chieftainship, and should have no powers beyond those necessary to protect the people from harm or to help them to better the conditions of their lives. It should contain no privileged or specially protected classes, castes, or persons. These are the commonplaces of common sense and will be denied by no one. The State, therefore, is in effect a book of rules so formulated as to enable each individual to make the most and the best of his abilities, and any persons assigned or elected to carry out such rules should be chosen not by favour, or by public or private examination in subjects which may or may not have any direct relation to their work for the State, but for their integrity, proficiency, and efficiency in matters connected with service to the State. Such persons should be highly honoured and well remunerated during their wardenship. (The permanent staffs of the different departments of State are apart from these elected controllers.)

There is an effort on the part of those in control of politics to suppress information concerning the principles and especially the practice of politics. No political teaching is permitted in State-controlled schools, and the people are kept in ignorance of one of the most important responsibilities of their lives, the consequence being that when the time comes for them to cast their votes the great majority have no knowledge of what they are voting for. Usually, it is not for some principle concerning the welfare of all the people comprising the State that they are asked to vote, but for a favourite candidate, a family tradition, a violent controversy on some unimportant issue emphasized by the politicians in order to divert attention from more serious matters. It is notorious that all political parties connive at hoodwinking the electors, and parliamentary candidates are selected for their wealth, position, or services to the Party, not for their intelligence, integrity, or knowledge of State affairs. It is generally recognized that the average intelligence of Members of Parliament is lower than that of the general public, and one can understand why the most pitiful exhibition of collective complacency is to be found in Parliament, where hundreds of men elected to express the views and opinions of the electors are dumb and docile in the assembly.

One of the greatest tragedies and perplexities of present-day man is that it is those in high places who bring about disasters, wars, and death. In every nation the common man desires only to go about his affairs peacefully and diligently, but the ruler, the diplomat, the politician, the industrial magnate, the financier—all well-educated men—drive them to passions and hatreds which are almost entirely artificial and which lead to violent and bloodthirsty deeds. And when wars and disasters come to a temporary end these men in high places have the audacity to assume the credit for bringing about an end to the very disasters they have caused.

II

An examination of modern statecraft compared with human development shows it to be relatively in the mental condition of the anthropoid ape. It is without any semblance of honour or integrity and depends on brute strength and cunning to obtain its ends, obeying no principles and responsible only to itself. One of its great leaders has said that "even at best politics is a dirty business." It grasps all it can and holds on tenaciously even at the risk of political death, yielding only when faced with irreparable disaster, and sometimes not even then. It is blind to the advantages of co-operation and mutual trust with those it governs. It has little or no thought of the morrow, for it piles up burdens which must be carried by future generations for hundreds of years, if they manage to survive under them. It constructs an internal organization which protects itself in entire disregard of the general welfare of the community. It wastes the nation's substance in scores of ways, and the more it wastes the more importance it assumes. This sort of statecraft is primitive and barbarous when the requirements of present-day industry and science are considered, and you who read this will understand how far removed it is from that Intelligence whose only aim is to bring about harmony in the universe, and peace and goodwill into the lives of all humanity.

The present methods of selecting the rulers of nations and electing the people's representatives should be abandoned, because they only result in disaster, whether of a civil or military nature. Obviously, these methods will not be altered by the representatives, and revolution is too drastic and evil. One simple means of improvement might be by the collective action of persons engaged in scientific, industrial, and economic pursuits. Representatives of these persons would form an organized political group meeting together in a "Parliament" to consider current affairs and to discuss the best ways of development for a progressive people, ways which would include the welfare of *all* those comprising the State. Their decisions and recommendations would be communicated to the Government with the request that they be carried out. To begin with, the Government would treat this group with amusement and contempt, but the group would make no endeavour to force its decisions or put them into practice apart from the Government. It would publish its own method and that of the Government side by side without comment of any kind, but it would see to it that the publication came into the hands of all electors; the matter would then take its course. It would generally result in the Government putting its own methods into practice, but it would soon become evident that the methods suggested by the group were far more efficient and would meet the special conditions and needs of the people much better than those of the Government, with the result that the Government would have to alter its methods or be condemned by the electors, who would replace the Government by the group, this being the more intelligent and effective body. And so without any sort of revolution a new and more honourable political status might arise.

We are, however, very far from such a desirable method of conducting the State, and we have to deal with electors who are inclined to follow the man with the biggest voice. The majority are not influenced by thought, by the careful study of affairs which affect their lives and liberties. It is usually only when their immediate welfare is at stake that they listen, and then only to those who appeal to their passions and prejudices.

The broader issues of progress, change, new ideas, originate and are carried out only by the intelligent minority, and control should be left in their hands. The majority should act as a safeguard, this being the real function of democracy, for although democracy means the rule of the majority, such rule is impossible, because the majority does not know how to rule. By the nature of things, the greatest intelligence is found in comparatively few people, and it is obvious that the State ought to be controlled, advised, and governed by those of its members who have the greatest intelligence and not by those merely elected, without qualifications, by the greatest number of people if, of course, intelligent rule is desired. Again, democracy does not want to rule; it wants to be told, to be guided, to be instructed by those it can trust.

The government of the people—of the peoples of the whole world—should therefore be in the hands of men best suited for this most highly responsible position. They should be educated especially for it after they had proved their ability in this direction by a general knowledge and understanding of the meaning of government. But democracy is absolutely essential as a safeguard—without it, government would be no better than it is now, and a few men could drive the State into irretrievable disaster. Every member of the Government, including any sort of Parliament or House of Representatives, should be individually responsible in his political behaviour to all the people. Any member who for any reason whatever displeases a minimum of, say, one hundred people should be immediately suspended and an inquiry made into the cause of this displeasure. If found unsatisfactory or inefficient or in any way unfit for the high position with which he has been entrusted, he must be dismissed and will never again be allowed to take up any position in connection with public affairs, and if considered necessary he should be punished justly in relation to the degree of his betrayal of the trust which has been bestowed upon him. But if he refers his case back to the people and a plebiscite shows a majority of not less than ten to one in his favour, he may be reinstated. Such a check is necessary to avoid a clique in the Government endeavouring by underhanded means to get rid of a man of independent spirit or one who may be in advance of his time though the people trust him. By these measures it will be seen how highly important democracy can become while at the same time not interfering directly with government.

All electioneering or any public appeal whatsoever, whether individual or with reference to public affairs, should be by written appeal or argument, never by public meetings and speeches. Every person attaining the age of twenty-five should have a vote, but a progressive series of examinations in civics, politics, and kindred subjects would be arranged, and at each stage success would carry an additional vote, because those who studied these subjects would be better qualified to elect the best persons to represent the people.

The details of such a method of government need not be discussed further here; it is but a brief suggestion which would enable the people not only to take a keen interest in how they were governed but would place ultimate power in their hands with the least interference with policies and the intimate details of government.

III

The harmonious equilibrium of the organism is the sole concern of Intelligence; hence individual welfare comes first and social affairs follow, though these are equally essential for existence. Morals, ethics, social behaviour, being environmental, are aspects of the relations between men, and, inasmuch as they tend towards the general good, they are desirable in their harmonious effect on the individual. As individual and environment react on one another this is to their mutual advantage, but, quite definitely, there is no Intelligence, acting apart from individuals, to which all must conform or which they must obey. We undoubtedly have groups of individuals meeting together in order to act for the general welfare. Societies, institutions, coteries, herds, swarms, flocks are all mutually advantageous, but they are essentially collections of individual Intelligence. Hence, men must plan their own social affairs with their experience to guide them, because Intelligence cannot control *social* conduct.

For instance, the problems and difficulties of economics are due to the fact that this subject deals almost entirely with man's affairs, which are largely artificial. Man blunders into difficulties because he raises barriers against his fellows or against society in self-defence, self-protection, or for self-advantage. In raising these barriers he does not understand or appreciate the effect they will have on society, or the reactions on the part of his fellow-men, and especially those who are adversely affected by them. But these are the natural reactions of aggression, and place him in difficulties he did not anticipate, difficulties he can neither grasp nor solve. At present there is always a smaller acquisitive or aggressive society within a larger exploited or defensive society: one rich, the other poor; one powerful, the other weak; one controlling the means of existence, the other accepting what it can get.

These difficulties and problems constitute economics. They can be overcome only by eliminating causes—that is to say, by all men serving the common good instead of their own. And this can be done only by the exercise of their associated intelligences, which will enable them to perceive that the good of their fellow-men is essential to the good of themselves. But it will be many years before men have sufficient common sense to realize that the ultimate good, the one most to be desired, is the common good of all humanity.

The greatest increase in population at present is among the poorer classes. No thought is in their minds concerning the consequences of marriage; an instinct or a pressing desire is satisfied and another human being is brought into the world. There is no guiding power here for, if so, such power must be responsible for those who are born and live and die in misery. As the earth is over-populated—normally, twelve millions of people in Britain alone, the wealthiest country in the world, being on the verge of starvation—these births should be prevented, and the blame for all this misery rests with those in authority, who resist the spread of knowledge concerning birth control and who acquiesce in this misery while putting the responsibility on their deity. This blame is all the greater when it is remembered that Britain could easily produce commodities for a much greater number than these twelve millions, but those in power would rather have this destitution in their midst than do anything which might, in their opinion, prejudice their positions and control of power, authority, and wealth.

It is, however, the general intelligence of the race which is being prejudiced, because in periods of plenty the less intelligent people, being in the great majority, increase much faster than the more intelligent. Even if the number of children per family could be restricted, this would continue, and the general level of intelligence falls. This may seem of little importance so long as the less intelligent do not secure control of power, though how this is to be prevented it is difficult to imagine in a world of mass deterioration of intelligence.

There is one interesting point which may be mentioned in this connection—namely, whether the intelligence of the poorer classes is organically lower or whether it is merely undeveloped. Many ignorant and uneducated men attain high positions more or less accidentally, and they become both intelligent and efficient. In some extreme cases it is found that a grocer, a journalist, a chemist, a stock-broker, becomes a millionaire and is raised to the Peerage. And it is not always a determination to succeed but some odd chance that provides the opportunity. This indicates that given the opportunity a great many ignorant persons may become both intellectual and responsible, which means a definite mental progress, probably due to the sheathing of more neural axons (see p. 49) and, if so, the general intelligence of the race seems to be low because its inherent possibilities are not encouraged under present social conditions—a hopeful outlook for the future.

But this is perhaps looking too far ahead. At present nature brings offspring; civilization and the struggle for existence in a world teeming with plenty bring poverty and destitution. What can possibly be done to remedy this? Either life must be made unnatural by the deliberate restriction of offspring, or the suffering, which is wholly unnecessary, must go on. All one can suggest is that methods of distribution should be seriously studied and the production of commodities should be controlled by all Governments in order that they may be distributed evenly throughout the world. This is by no means a difficult matter. The trouble is that those in control of industry will not allow production to be dealt with by Governments except in times of war or crisis. It is quite probable that in the near future Governments will not be subservient to producers, and in such event there will be a rapid reorganization of industrial affairs. It is already an outrage on humanity that a few extremely wealthy persons in each country should hold the world to ransom.

There need be no fear about over-population under such conditions. It is more likely that, in the future, the real difficulty will arise when the population is waning in the midst of plenty simply because women will refuse to bear children. But this also will be remedied; the mothers of the race will be so honoured that motherhood will be eagerly sought. So the see-saw of population in relation to plenty will always balance eventually, though on occasion it may sway rather alarmingly.

Until that time arrives we must look forward to a great deal of misery, destitution, and crime in many parts of the globe. We may also expect more and more wars, for even when the white races become sane in this respect, men are so divided that sooner or later there may be a terrible war of extermination between the white, yellow, and black races.

In these matters of Government, politics, education, social relations, industry, the hand of authority presses heavily on the liberty of thought, speech, and action, and endeavours with all its power to rescind the freedoms won by the very people who should be helped, encouraged, and defended by the State.

IV

Our prejudices and opinions are often based upon information we receive from others, especially from those who are in positions of authority, but our own thoughts and judgments are of greater value to us because we then understand better why we hold our opinions, and we are not so susceptible to coercion and intimidation, which may incline us to accept reluctantly opinions of which we are doubtful. Whenever pressure or compulsion is put upon us to accept the opinion of others we may be sure that some evil is intended, that some untruth is being foisted upon us, because no coercion or compulsion is necessary to make us believe in what is true.

If life is to be noble it must be so for all and not for a privileged few. But how can the bucolic labourer, the unskilled worker, the witless hobbledehoy, the chore-bound wife, achieve the nobility of life? They cannot! The possibilities are within them, but their heredity, ignorance, environment, education, prevent them from understanding any of the things which make life noble. Only a social change which will on the one hand provide opportunities for everyone to develop the best that is in him, and on the other will raise the standard of intelligence by preventing the production of the feeble-minded, will bring about this desirable condition. It is here that we must turn to Intelligence for guidance; with it we shall quickly learn wisdom; without it the stupidity and folly of our social system must continue until our inevitable doom overtakes us.

As yet man seems unable to grasp the fact that he is a definite part of the universe, that he is made up of the same materials, the same wave-lengths, the same infinitesimal vibrations as all other forms of matter and energy. The insignificance of the earth in relation to the immensity of the universe should make him realize that while he is part of the universe, his origin and development are due to the conditions of this earth, and it is only by concentrating on earthly affairs and by creating a condition of things which will make for progress here on earth that harmony will be effected. His actual achievements show the possibilities of this. Already he has parcelled out the whole earth into definite areas occupied by the nations; he has interfered with natural boundaries and restricted wild animals and plants to districts beyond his cultivated lands and reservations; and recently he has altered the fundamental nature of life itself by creating new species of plant and animal; he has utilized sound to express his desires and has thus created speech; he has converted speech into writing and thereby enormously widened the dissemination of ideas; he has reduced the anarchy of tribal factions and practices to established custom and law; he has tamed the animal to serve him and sown the seed to nourish him; he has bent the unseen powers of nature to his will in fire and metal, in wind and water, in light and magnetism. Surely, then, the changing of society in order to bring about the welfare of all men is not beyond his powers if he will but use the Intelligence which is in him. That he has introduced into his world poverty, misery, evil, sorrow, slavery, conscious wickedness, and the seven deadly sins as well as others which are deadlier should be a guide to what must be avoided. Not until these changes have been made will he be able to appreciate to the full that wonderful, mysterious life which is so magnificent, so miraculous, and so well worth while.

CHAPTER XIV

THE FUTURE

I

THE scope of thought and knowledge has been greatly enlarged by language, writing, discovery, invention, and research, so we may hope, even if we dare not assert, that some new phase of human development is not far distant. As a blind man whose eyes are opened enters into a new world, so we may develop some new or amplified sense-apparatus which will open up new ways of contacting with Intelligence, ways whereby a true understanding of that harmony which Intelligence is ever seeking may be approached, if not actually achieved. Many phenomena at present unperceived, but the existence of which is indicated by their effects, must have a reality behind them, and if this is discovered the range of knowledge will again be extended enormously.

We are, in fact, barely at the beginning of our understanding of life and the universe, and it cannot be assumed that just getting into touch with Intelligence is all we need; but our knowledge is as yet rudimentary, and science is in its infancy, and we may therefore reasonably suppose that a general contact with Intelligence will lead to possibilities of knowledge and understanding that would seem quite miraculous to us at present, for, where Intelligence finds opportunity, it advances rapidly. The intelligence of the Greeks between 600 and 200 B.C. was such an opportunity, but they did not grasp the meaning of Intelligence, though they came very near to it. The recession of intellectuality that followed the destruction of Greek civilization shows clearly enough that the progress of the world is not by wars, antagonisms, conquests, but by the peaceful spread of knowledge to all people, by the study and control of nature, by increasing the status of the people and eliminating poverty, by abolishing fear, by encouraging liberty of thought, speech, and action. Had the Greeks not been destroyed, the advance towards harmony would by this time have led to a race of men who could with good reason be called supermen. It is for us now to set about creating that race—if the prospect is sufficiently attractive—and surely anything is better than our present relapse into the dark ages by war and industrial slavery, by a rapid approach towards physical and mental deficiency which has already set in.

Environment expands with every advance, every change, and as we become more complex, so does our environment. We can never overtake it, we shall never want to overtake it when we realize its true relation to us. What we do want is to be in harmony with it, and then the more complex it becomes the more wonderful, the more satisfactory, the more complete, life will be. But if the increased complexity of the environment is not understood, if we make no endeavour to keep up with it, if we progress at a slower speed than our original environment, then we get farther and farther away from harmony and deeper and deeper into the morass of misery and despair—until at length we sink under the burden we put upon our own shoulders and disappear, wretchedly and deservedly, for ever.

As we create our environment, so shall we—so *must* we—create a world of good or of evil, of weal or of woe, not national or parochial or limited in any way, but universal. Evil is obviously the creation of those who rule by might and by force; and as evil destroys itself, so ultimately those who rule by might destroy themselves, or else leave behind them the evils they have created, which will inevitably destroy whatever work they may have done. Thus, evil will always disappear in time; it is our business to see that the process is accelerated.

We are always living for the future, always hoping and endeavouring to attain an equilibrium that is rarely, if ever, achieved, because existence is in the present; there can be no existent future. The present gradually creeps towards the receding future and fulfils old futures while it visualizes new and remoter ones. Living for the future instead of for the present is the natural consequence of primitive man observing the procreation of his animals, and noting the succession of the seasons, flower producing seed, the fullness and fall of the leaves, and the changes in connection with all those things serving his needs. The domestication of animals, the sowing of seed, the harvesting and storing the crops for future use, the cultivation of the land, and the re-sowing of seed, all necessitated a close observance of the seasons, of the movement of sun, moon, and stars, in order to make provision for future events. Thus man came to look to the future for results, hence to live for the future, and with increasing knowledge and control, and wealth in cattle and grain, the future became more and more important, until it has now become a greater factor than the present, and we are in danger of losing our real existence in a future we can never experience.

At the same time, we can visualize a future where life will be much easier for mankind than it is now. A single language will prevail—it ought to be in existence now. Mathematics will be on a different numerical basis—why our mathematical genii have not adopted a duodecimal basis (the number 10 representing twelve units instead of ten) to replace the decimal one passes our comprehension. Food and clothing will be richer and yet simpler. Health will be better as the stock becomes sounder. Knowledge will be easier to assimilate because Intelligence will have better methods of expression and the brain will be a finer instrument. The lengthening life, an education fitted to each person's mental capacity, a greater economy of thought by the simplification of language with its finer meanings, the restriction of parenthood to those who attain high standards of mental and physical health, the production of children from the love-unions of parents, will result in a people capable of appreciating fully the beauty and wonder of life, and their lives, though limited to eighty or a hundred active years, will be equivalent to something like 1,000 years of the best brains now existing; for it is not in the number of one's days but in the greatness of those days that life will be amplified. Life will then be thrilling in its intensity and in its interest, and there are a thousand million years of it to look forward to. Such a period compared to the life of a man is so great that it may be called eternity, or "for ever." Even in one million years the earth and man will have changed beyond recognition. Vegetation will have altered completely, animal life will be extinct except for those forms necessary or pleasurable to man—and these, too, may have passed away. This is assuming that man still exists, for he will control his environment completely. Such a world would not appeal to present-day man; to the man of the future it will approach perfection, for his work, his pleasures, his ambitions, will be nobler, purer, and nearer to that Intelligence which moves the universe, but which as yet seems so far away from us.

II

To return to earth. In the past, wave upon wave of development occurred until the high-water mark of physical development was reached with primeval man. Now a deterioration has set in, but a secondary series of wave-like advances in mentality has begun and still goes on. By controlling the production of human beings who are capable of physical as well as mental development a new race may be created. It is quite within man's power to do this, because Intelligence is always urging him in that direction, and if reliance is placed on it man will always aim at that which is good, and so progress will advance with every generation—though it is impossible to attain perfection in an environment which must necessarily change as man himself changes.

To produce the right type of human being obviously means a somewhat rigid control; those who are physically, mentally, or morally tainted must be restricted, and this will bring about a new morality, a new ethic. This task may take fifty or 5,000 years to accomplish, but it is one that may be entered upon joyously and with determination together with the knowledge that though the end recedes as it is approached, it is a wonderful adventure and one that will reward us amply and nobly, even in individual failure.

The stamina of the human race, its power to adjust itself to its natural environment, is decaying. There are more mental defectives, and especially more morons, more dullards, now than ever before in proportion to the whole population. Health is maintained only by recourse to medicine and surgery. If man could be placed in a natural environment without adventitious aids, the mortality would be appalling. He cannot always be kept alive artificially, and must sooner or later meet nature face to face and conquer it or collaborate with it if he is to go on developing; otherwise Intelligence in the environment will overcome Intelligence in the individual, nature being more powerful than artifice in the long run. Nature, then, should always be our guide, our book of reference, if we are to make sure progress.

The brain, as the most important organ of the body, must receive special attention. Those whose brains are below average should be discouraged from procreating their kind. But we must be very sure of our ground, because as yet we are uncertain of the exact relationship between "*mens* *sana* " and " *corpore sano.*" We should judiciously, humanely, but unhesitatingly eliminate those infants who are, or are extremely likely to be, unfit. At birth they have no self-consciousness and will suffer far less by dying than by living. If they are allowed to live, the happiness they obtain from life will by no means compensate for the unhappiness they will be compelled to suffer. The elimination of the unfit does not mean extermination. It means that under rational conditions the unfit will not be born and that particular type of humanity, the feeble-minded and the sub-intelligent, will no longer come into being.

Any suggestion of sex freedom has a tendency to fill us with dismay and disgust, but this is only convention and has no real bearing on the fundamental rightness or wrongness of the suggestion. It is to sex freedom that we must look for a better race, because any limitation on sex means imposing irksome conditions, and this in its turn means limiting the freedom to produce the best type of offspring. Sex freedom does not mean promiscuity; that is a return to the beast. It means a free choice of mating for love and the control of parentage. It will be long before such freedoms and controls become the common practice, because this is the sort of thing that may lead to licence unless it is brought about in the spirit of the welfare of the race—a spirit which is as yet far off. We rather suspect that we who write this would still be in the womb of time had such controls been in force now, but that does not affect the principle.

Primitive man was much closer to Intelligence than modern man. The latter has moved away from it by language, writing, social life, invention, slavery, destitution, exploitation, conservatism, restriction of liberties, and has omitted to keep in touch with the guidance and promptings coming from within him. He cannot be blamed for this. He has inherited an organism which has become too susceptible to immediate sensations; the senses loom too large in his understanding of the universe, so that as yet he pays little attention to the more important influence of his brain on life and its meaning. The satisfaction of the senses, the gratification of passions and desires, the avoidance of discomfort, the suppression of pain, the attainment of power, are more to him than a real knowledge of life and the direction it is taking. The consequences are plainly to be seen in his discontent, his boredom in riches, his misery in poverty, his ignorance of affairs, which leads him to disasters in finance, politics, wars, disease, and sordid death. Whether he will ever cut loose from the domination of the senses is a matter for the future, but he must do so or be eliminated. The alternative is to get into closer relationship with the Intelligence within him, which will enable him to understand and appreciate the marvellous thing he really is and how trivial are the things which at present he most values.

A conscious co-operation between Intelligence and the mind would lead to an immediate and enormous advance in understanding, and would open up new experiences, new objectives, new deliberate attempts at creative development, and a new direction to all human activities—a direction leading towards that harmony which would make life a glorious song. Moreover, it is quite possible that a great development of Intelligence may take place without the necessity of a changing or evolving body, because we have developed so far mentally, and the brain is so receptive to progressive ideas, that enormous advances may be made in understanding truth and reality even though our minds and bodies remain stationary—though this could not go on for very long.

III

It is extraordinary how naturally certain social conditions, relationships, and practices become imperative when society is contemplated in the light of Intelligence. Here are a few :—

Liberty of thought, word, and action;
Personal and economic security;
Production of all goods for use instead of for profit;
Common ownership of land and all things affecting the common welfare;
Equality of education, opportunity, social condition;
Freedom to elect political representatives and heads of the State;
The unity of all peoples;
A universal language;
Freedom to travel and to trade in all parts of the world;
A universal currency;
Universal weights and measures;
Purity of all substances for human consumption.

These are not the articles of a creed but the obvious essentials of a basic humanism. Who can object to them? How rational and needful they are will be seen if they are compared with their opposites.

A difficulty which seems to be insuperable in converting the present system of industry to one of common ownership and production is the manner in which this may be brought about without revolution or very serious disorganization in social, political, financial, and industrial affairs. But all that is needed is for the Government to enter industry as a producing organization. To begin with it would be a simple matter for railways and all forms of transport to be taken over, as this has already been done in several countries. The mines could also be taken over quite easily: or, if the mine-owners demanded excessive compensation, certain mines could be purchased and new ones opened up, and the coal and iron produced would be sold at competitive prices. Agriculture and farming could be done on a large scale and the products sold direct to the consumer in Government shops. Clothing manufacture could be begun on competitive lines with little difficulty; the huge clothing, cotton, boot, and other factories would be a guide to their organization and management.

After food, clothing, housing, coal, transport, electricity, gas, water were under Government control in competition with individual Capitalism, everything else could be left in the hands of private individuals and companies; or, in the event of profiteering, hotels, restaurants, theatres, holiday resorts, games could be carried on competitively by the Government.

The cry of unfair competition would be met by all Government concerns being compelled to pay wages and provide workshop conditions which would be as good, if not better, than those obtaining in the capitalist factories, while goods would be sold at competitive prices showing a reasonable profit, which would be used for developing further the Government control of industry or in the reduction of taxation or for other common purposes.

The greatest danger would be slackness, incompetence, inefficiency, indifference, on the part of the staffs of the Government factories, this being the most disastrous feature of all public departments and offices at present, and it would entail careful watching and very drastic treatment until a new spirit of honour, probity, conscientiousness, and incorruptibility spread throughout all Government departments. In the meantime, any tendency to slackness, inferior workmanship, low production, would be severely dealt with not only by the instant dismissal of the offending persons but also by preventing their re-employment in any capacity whatsoever under the Government—they would be marked men, being traitors to the welfare of the State no matter how high or low their positions.

A system of rewards would be an encouragement to all classes of workers in factories, shops, and offices to perform their duties to the best of their ability, both as to quality and quantity of productions. Management of this kind is already in operation in many places and could be introduced at once into Government workshops and enterprises.

Objection to such Government control of industry would come from capitalists and labour leaders, but captains of industry and leaders of labour are men of energy, determination, and ability, and these are the very men who would be most needed and who would take the lead in the sort of organization necessary for the satisfactory operation of the new regime; but instead of working for profits or private advantage they would have positions of honour and trust, and their rewards would be commensurate with these positions and responsibilities.

In this manner the whole of the industry of a country could be gradually and smoothly converted from individual to State ownership without difficulty and without revolution or any serious industrial disorganization, for such a step-by-step progress would ensure safety and the certainty of results. The many instances in different countries where Government control and ownership are already in operation would be instructive in building up a complete system of State control on sound foundations, and as the advantages became apparent the whole principle would be automatically speeded up by the demand of people of all classes for the universal benefits which would ensue.

One striking feature arises out of State ownership generally—namely, the impossibility of war. States governed by freely elected representatives, whose only object was the general welfare, could never consider the possibility of war. Only in the event of a capitalist-controlled State threatening to make war would arms be taken up, and that most reluctantly after all peace offers had been rejected. If all States were so governed, it is obvious that war would be utterly unthinkable, and the only " strife " would be the striving of every State to keep efficient and in the forefront of invention, discovery, and research, together with the application of these to the welfare of all the peoples of the world. This will come inevitably, but unless men can dedicate their lives and their work to the general welfare instead of to personal ambition, the acquisition of wealth, the lust of power, the attainment of this desirable condition of things will be delayed indefinitely.

How curious it is that the huge majority of mankind seems to prefer to work for a gaunt and greedy individual capitalism which tramples on its soul and grinds its face in the dust while flinging it a crust as one throws a bone to little dogs, rather than for a system that will bring a glorious freedom, loyal companionship, and a sublime manhood—and even at the present time men hold in their hands the opportunity of bringing about this system merely by exercising their voting powers under the law !

The only excuse for postponing the adoption of State enterprise and ownership of industry is that the time is not yet ripe for doing so—and that is but a matter of opinion, an excuse made by those in high and privileged places. What do the great majority—those in low places—think of it ? In the future there will be no such classes—there can be only those who differ in their expression of life, weaving the weft and woof of their individual personalities into the differing patterns of one great fabric of humanity. Under Intelligence there can be no favourites, no preferences, no privileges; for every man, however humble or however great, is himself Intelligence, and so long as he lives he is its exemplar.

These conditions and practices have their natural corollaries, developments, or extensions. Through them all, races and nations may extend the hand of a true and loyal friendship to one another and may work together for the betterment of all mankind, whereby the world of men will become a finer and closer brotherhood—and so the United States of the World will emerge. . . .

IV

Now, there are no particularly novel suggestions in this book. Many of them have been much better expressed and in much greater detail by writers who have made special studies of them. But an attempt has been made here to bring together some of those things which influence man in his development, and to show how very easy it will be to bring a new world of men into being with the slightest adjustments of existing human relations aided by an understanding of that Intelligence which is the real creator of the universe, which is the forerunner of all change and development, and without which it is very improbable that man can ever rise above his present conditions of life, because he has reached a stage where he interferes with its work by introducing artificial hindrances to natural progress to such an extent that his physical nature has perhaps already passed its zenith.

It may seem paradoxical that man can interfere with Intelligence, but from what has been indicated in the foregoing chapters the reader will readily understand how such a state of affairs can have arisen. We must consider progress and development in the light of man's collaboration with Intelligence, and this chapter indicates the general direction which should be taken if this collaboration is to be brought about. The way is quite plain. We must adapt ourselves to Intelligence in such a manner that it may come to its full expression in us. We need not do this, of course; we can blunder along in the old way, obstructing our own evolution, and hence that of the race, but this is so silly that only feeble-minded or evil persons would adopt such an attitude when they are aware of what it means.

We have reiterated many times that if we are not exterminated the good will win through, but every cruel act, every untruth, every vice, is a crime against the individual, against the race, against social progress, against Intelligence itself, and obstructs the attainment of that harmony which is within our reach. Progress is largely in our hands, and may advance slowly or quickly, according to the degree of our co-operation with Intelligence.

Consider the position from any point of view. Let us assume we are trifling negligible quantities in the universe—yet we have wisdom enough to visualize a possible condition where our troubles and sorrows are at a minimum, and our joys, our health, our loves, reach an ideal state. Assume, again, that we are the all-important results of the existence of the universe. Then surely we should aim at perfection in the nearest and quickest way. Assume once more that we are aiming at a perfection that recedes as we approach it. Then the nearer we get to it the more perfect we become, the more we realize our aim and the methods of approach, the more we hold fast to the truth and shed all falsehoods, inhibitions, customs, conventions, and other obstacles that impede our progress. So whether we are the crown and glory of the universe or whether we are but thinking animals of no cosmic consequence whatever, the Intelligence within us guides us to a more perfect life.

During the next thousand years—forty or so generations—why not make a serious attempt to set in order this temple of humanity? When that is more or less accomplished, the newer problems that emerge will keep us going for another ten thousand years or so, and all the time we are approaching and achieving it in the process and the prospect.

And now a personal note. No matter whether you are Deist or Atheist, philosopher or fool, scholar or ignoramus, judge or criminal, wealthy or poverty-stricken, now that you have read what is written here Intelligence will always possess you. Always you will find it emerging into your consciousness; always in your decisions and judgments the thought of it will creep in; always you will wonder whether your actions, words, and thoughts are in harmony with it. Not that you want it to interfere with your affairs in any way; not that you will be guided by it; not that any conviction will come to you from reading about it; not that you think it worth pondering over a little . . . but simply because you cannot help it. On odd occasions, in sickness and in health, in sorrow and in joy, the curious thought will cross your mind as to whether you are playing the game with Intelligence. You may curse the day you ever heard of it, if you are that kind of person—but you will wonder! You may scoff at the idea of Intelligence, but when you find that whether you like it or not it is actually operating within you even against your will and your desire, perhaps you will wonder again! Even if you deny Intelligence and become active in your denial, it will not desert you; it cannot, because you are Intelligence and it is you, indissolubly throughout your life—but you make its task heavier and more difficult by this denial, to your great ill-fare.

V

What is the object of all this talk? You and ourselves will soon be dead, so what do all these things matter? Why should we waste time and life in considering them? Well, what better can we do? Is the mean grovelling after a few extra pennies of more importance than the endeavour to understand the meaning of the universe? Even if we ourselves are trapped in the cage of ignorance and convention, is it not a gracious action to try to break the bars and let our children free? Shall we not find our own limited lives far more satisfactory if we attempt to explore all the ways of liberty? Suppose it all leads to nothing, is not the effort fine and soul-satisfying? What other aim in life can give so much real satisfaction? For ourselves, if no eye sees these lines we put down our pen with the knowledge that we have made an attempt, however poor and halting, to find the ways of truth, and even if our effort proves vain the joy of making it has been a happy adventure into the savannahs and foothills of the unknown and we have seen the light of truth upon the distant hills guiding all well-meaning men to a future that passes our present understanding. Should this book bring you under the same spell, you too will realize what Intelligence means, for it begets an inspiration which enables one to go about the affairs of life with hope, happiness, and confidence, with humour and a smile, with courage and strength, with magnanimity where it is desirable, with implacable justice where it is necessary.

Just one or two remarks before we finish. First, we have applied the word "Intelligence" to the creator of all existence, and this word has been defined sufficiently clearly to indicate its meaning for our purpose here. But there is no reason to be bound to this word; use any word you like so long as it means—Intelligence. It is difficult to grasp the whole of what is meant by it, and especially to realize that matter is not only a form of it but is, in fact, almost the whole of demonstrable Intelligence. If we say that matter is the materialized appearance of it and that the behaviour of materialized Intelligence is its dynamic expression, perhaps it will help towards an understanding of it. And then again, perhaps it will not.

Next, in covering such a vast field it has been necessary to select only those conditions of life and environment which bear directly on our theme, and we have tried to make this discourse a readable and connected account of existence in all its aspects from the hypothetical beginning of things to the natural and social worlds we live in. If any criticism be made of this account, the foregoing should be kept in mind, for we are more conscious than you of the many missing links, shortcomings, and incomplete expositions of the various stages in development from mitron to man. If you have studied any particular branch of knowledge you may be inclined to criticize severely the manner in which it has been presented here, if it has been touched upon at all. But let us say again that if destructive criticism is to be of value it should be in the nature of a clear, definite, and incontrovertible statement or fact or reasoning which will show that the principle of Intelligence we have tried to expound is false, inaccurate, and worthless. If you can prove clearly that, we above all people shall be pleased beyond measure, because you will be demonstrating and proving a greater truth and reality about the meaning of the universe and all that exists, and we can imagine nothing that would give us greater satisfaction.

Finally, we have addressed ourselves to the youth of the world because it is for youth to break the shackles that fetter the body and the spirit of humanity. It is for young people—you of vivid imagination and fearless courage—to fling on the scrap-heap all the old shibboleths, obsolescent conventions and customs, age-long restrictions on freedom of thought and expression, the case-hardened " authorities " which cramp and confine you, and those unreasoning and unreasonable compulsions which limit or prevent the adventure of the intellect. You are the creators of the new world ; the future is in your hands, and it is for you to make or mar it. You have now no fictitious external power to contend with, to conciliate, to submit to—all power is within you, and the more you advance towards harmony the stronger will this power become. It is for you to link your vision and energies with those ill-appreciated and under-paid men of science, the masters of the world to be and the true revealers of the secrets of the universe, and with them to raise the torch of liberty, of action, and of thought, that it may be a light to them that sit in darkness, that it may lead humanity to the margins of a glorious futurity where men will meet themselves face to face and find that they are good. The kingdom of Intelligence is within you and will, with your goodwill, lead you to the kingdom of heaven.

PART II

MAN IN RELATION TO DEVELOPMENT

IN Chapter V certain conclusions which arose during our inquiry into the action of Intelligence were mentioned, and the following chapters will go into more detail concerning them. The relationships between Intelligence and the universe are amplified, and it is hoped the discussion will not prove very dull or difficult. An appeal is made to those young people who have read so far to be patient and to make an effort to understand these relationships. We have tried to deal with the main aspects of life and the organism in order to show how the threads of Intelligence are woven into every part of nature, and, however crude or sketchy the method of presentation, if the reader will be diligent and read to the end, an understanding of our particular theme may be helpful in endeavouring to grasp other interpretations of the meaning of existence. And remember how vast the subject is and how limitations of space have necessitated concentration on certain definite phases of development to the exclusion of much detailed evidence which would support the general principle. An endeavour has been made to use simple terms and, as already indicated, we are not concerned with science generally, but only with those epochs where radical changes or " origins " appear, or where deductions have been made or theories formulated which do not seem to be justified when the phenomena and the inferences drawn from them are reviewed in the light of other possible interpretations based on Intelligence.

CHAPTER XV

THE ORIGIN OF THE UNIVERSE

I

PREVIOUSLY we have endeavoured to show that unthinkable things are of no value to us in our efforts to understand existence, and we concluded, rightly or wrongly, that any interference in human affairs by external agencies is one of these. In tracing Intelligence as far as possible towards its suggested origin we were driven back and back along the path which life has travelled in its development towards man, until eventually we arrived at the very beginning, which to us is the state where the thinkable merges into the unthinkable, and nowhere could we say where Intelligence began, or where Intelligence was bestowed on matter by an exterior power. Intelligence guided us to its own limits.

From the brief survey on pages 28–40 of development from primitive substance to man we concluded that matter and Intelligence are from the beginning closely associated, and, although this may seem to be a vast assumption, consider our own individual bodily constitution. We are made of flesh and bone, blood, nerve, and brain. Anatomize these and we find we are composed of cells with their nuclei, chromosomes, cell inclusions, and cell sap. Microtize these and we find we are organic compounds, protein molecules. Disintegrate these and we become atoms of various sorts and sizes. Physicize these and we are reduced to neutrons, protons, electrons. Mathematize these and we flow about inside ourselves as waves and quanta. Relativize these and we are reduced to mathematical points—that is, to nothing in energetic motion. (" Electrons are considered as *mathematical* points in which the whole charge is concentrated.")

So here we are, right at the beginning of things, actually in ourselves—in our real selves. You, yourself, as you read this, are, without any shadow of doubt, but a complex mass of protons, neutrons, electrons, quanta—things travelling within you almost as fast as light. If we keep in mind what it is we really consist of, and that our bodies and brains *are actually derived by gradual* stages from the elements of a fiery nebula, then a collateral *gradual* development of Intelligence will not seem so extravagant as may at first appear, however much we may hesitate to accept such a suggestion.

If we are organically composed of the most primitive form of substance, then we contend that it is reasonable to assume Intelligence to be a part of that same substance, inasmuch as it obviously exists in man and can have been developed only from this primitive source or by interference from something entirely outside matter and beyond Intelligence itself. And in man, where does Intelligence begin and where does it end, if he as a whole possesses it, while his organs, muscles, bones, blood, corpuscles, glands, nerves, cells, molecules, and atoms of which he is composed are without it? We may say Intelligence is in the brain, but while this is undoubtedly the seat of its greater development, we cannot reasonably say that the other parts of our anatomy are without it, because there are many nervous reactions—reflexes—apart from the brain, and many repairs and adjustments are made during the natural processes of life independently of the thinking part of the brain, and these can take place only if they are to some extent controlled by an Intelligence similar to that possessed by the brain. To acknowledge Intelligence in the cells of the brain and to deny it to all the other cells of the body—which must include the zygote from which body, and the brain itself, are derived—is unwarrantable.

II

We traced Intelligence to the borders of the unthinkable, where it was linked with original substance. Here it was reduced to such fine proportions that it bordered on the homogeneous—that is, it became almost unthinkable, for perfect homogeneity is quite unthinkable. Can we think about heterogeneity any more clearly than we can think about homogeneity? We imagine we can, somehow; we seem to be able to think of primitive substance consisting of particles which are limited, which are self-contained, while it seems quite impossible to think of it if there are no differences whatever. But the universe could never have evolved from homogeneity, because to do so some exterior influence must have acted on homogeneity to make it undergo a change, and we have rejected such interference. We are thus compelled to conclude that homogeneity is unthinkable and that the universe of matter, atoms, stars, planets, and organic beings could not have evolved from it even if it were thinkable.

The most primitive substance we can think of must therefore have been heterogeneous. Human curiosity endeavours to find a state beyond which nothing further can be imagined, and the idea of heterogeneous particles seems to be this limit; also, light, gravity, electricity, seem to need some sort of limiting environment, as well as a primitive source, if they are to have any effect in the universe. The substance which forms such environment and such a source must be a form of matter so elusive, so indefinable, so refined in its nature, that there is difficulty in imagining any sort of material substance, however minute, that will fulfil these conditions, so we try to imagine heterogeneous particles even if we cannot imagine any properties they may possess.

Now, heterogeneity introduces extension and duration, for if anything is heterogeneous it must consist of particles distinct from one another, and, if distinct, that can mean only individual extension, even if they are so small and packed so closely together that the extension is unmeasurable. And if the particles are to remain in existence, this implies duration, because without duration they would cease to exist. Such extension and duration, however, are unmeasurable, because there is no basis of measurement, every particle being the same and indistinguishable from any other.

If nothing further happens, these particles will just go on being particles from eternity to eternity. It is only when some sort of change occurs in connection with them that we approach anything we can think about. Change implies movement, and we may imagine these particles in motion—but what kind of motion? It may be a movement of revolution, a particle revolving on and round its centre, or the movement of a whole particle revolving in an orbit about a centre, or it may be a tetrahedral, cubical, or octahedral particle in vibration—that is, with a limited reciprocating movement.

Here we are in a dilemma, because the physicists all assume circular or orbital motions for the most primitive substances actually known—the structure of the atom with its nucleus, electrons, photons, quanta, and what not. A vibratory or reciprocal motion seems more primitive and would in some ways render atomic action more intelligible.

In either event this motion implies a new, a real, space and time. Motion must be relative—if only to the particle itself if it revolves, because this means a centre and a periphery, and this periphery must be related to its centre; orbital motion is obviously related to its centre of revolution; while a reciprocating translatory motion is relative to the matrix in which it moves. This motion has, in fact, *created the sort of time and space* we know. It is not yet actually measurable, because all the particles are moving in exactly similar spaces in exactly similar times. They still have the qualities of infinity and eternity, but we seem to be able to think of this state of things though it is only by analogy with things about us that we are able to do so.

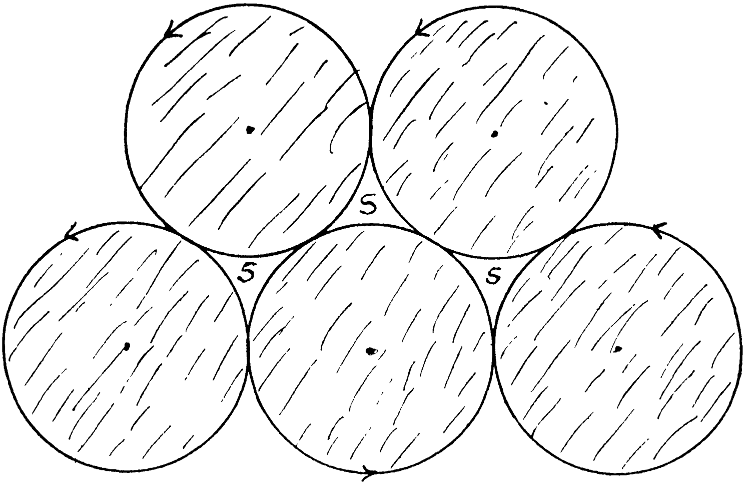


FIG. 1.—Primitive particles. Spherical (orbital atom); consisting of electrons revolving round a central nucleus. S S S are spaces outside the periphery of the particles and consist of nothing.

But we are no farther forward with our world, because nothing is really happening as yet; and the scientists have landed us in an impossible position, because by applying orbital motion to primitive particles these move in circles or spheres and touch, or may touch, each other at one point in their peripheries (see Fig. 1). This leaves spaces where they do not contact with each other, but there cannot be spaces outside the particles, as this would be another kind of space created in another manner, and it would have no time factor, so it could not remain in existence; yet it must always be there if the particles are there. Should the particles be tetrahedra, cubes or octahedra, then when they are in motion there would be no such unaccountable spaces (see Fig. 2), and they may have different properties or produce different effects in relation to their several possible movements. You see why we prefer a geometrical particle rather than the sun-and-planet principle of the physicist; it makes " creation " more credible.

Now we come to the next step—the first epoch of change and of development, the beginning of the measurable universe. Some of these particles escape somehow from the dull round of particulate toil and set out on an individual career of their own. This is a tremendous supposition, but one that must be made; otherwise the world would never have existed—and where should *we* be then? The motion of these particles precedes the formation of the physicist's atom, the atom being a much later development resulting from the actions and reactions of the particles between themselves, and between them and the matrix of heterogeneous particles from which they escaped.

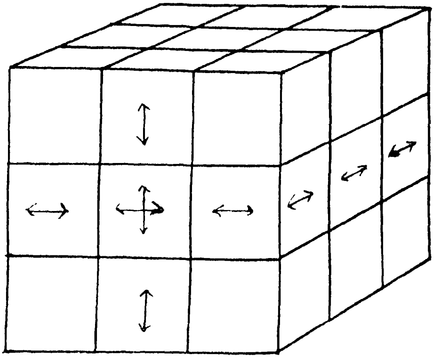


FIG. 2.—Primitive particles. Cubical. No spaces between them. Particles vibrating, or in reciprocal motion.

III

So we arrive at a primitive particle moving in a manner different from that of the common run of particles. It is erratic in its action, and in breaking away from convention it has become the foundation and origin of matter, of the elements, of the universe, with everything in it—of you and us, our table and pen, light, food and music, life and love. These particles act erratically—not because they *must*, but because they *do*. A little reflection will show that there is no *must* in the primitive universe. *Must* implies external interference; and if there were such a thing it would be particulate also; or else an entity or power which can exert a force, and a force cannot be exerted without a material basis, which again must be particulate.

Not until particles come into contact does *must* enter the universe. It is obviously impossible for one particle to control another or to become subordinate to another. They adapt their action each to each, and this introduces limitation, their absolute freedom being curtailed. As each particle acts in this way, compulsion or *must* seems to be necessary. When they act in concert, particles have an apparently united mass, and this mass group has correspondingly greater effects and adapts itself proportionally to other groups. In this way there arises complex action—the beginning of matter and of the universe.

What induced the particle to make this inconstant, this erratic, movement? What but Intelligence? It cannot have been anything else—if it happened. We have ruled out any external interference and we have traced Intelligence back from man to the most primitive form of matter we know; it is only extending our argument to assume that it goes back to this erratic particle and its movement.

As we shall have to discuss this primitive or ultimate or erratic particle, or whatever it is, we have followed the example of the scientist and given it a name. On page 41 we called it the " mitron," derived from " mite," meaning very small, and " ron," a scientific termination. It is, of course, less than any other physical particle, whether electron, proton, neutron, positron, mesotron, neutron, photon, or other yet-to-be-discovered lesser thing. " Mitron " is an omnibus word. It includes not only the existence of something but also the manner in which it exists and the way it expresses its existence, all of which are one unity, a sort of trinity. All phenomena are the different forms and relationships of this fundamental reality—the mitron.

Now we come to a difficulty—we shall meet with many in this book. Is Intelligence apart from the mitron, acting on it from without? If so, this means interference from outside and would be the only instance where such interference could be admitted—it would be the First Cause. There would then be a duality in the universe, a First

Cause and something (the mitron) on which it acted. To be consistent with our self-imposed limitations we should have to explain how the mitron on which the Cause acted came into existence without any Creator or Cause, and then how the Cause came into existence, and how it attached itself to the mitron and made it do or perform things. This is beyond us!

Is there any alternative? May we not say with greater reason that the *heterogeneous particles are composed of Intelligence itself*—that is, they are particles of Intelligence—and as they are separate, being heterogeneous, they have individuality, and some of these particles of Intelligence put themselves in motion? This motion is not of the same order as that of the heterogeneous particles; it is erratic and not constant, the particles move erratically and so the mitron comes into being—a particle of motive Intelligence. And infinity and eternity are no longer universal, because limitation and time are now in existence, as effects of mitronic motion.

This is the deduction—or assumption if you like—on which we shall act in what follows, because it seems to us to be more reasonable than any other. It means that everything in the universe possesses Intelligence of an extremely simple or extremely complex nature according to its state, with all grades between them. It means, further, that the elements and all that arises out of them, even to man's brain and behaviour, thought and imagination, are but the forms and actions which Intelligence takes in adjusting parts of itself to other parts in its persistent endeavour to maintain harmony between all its parts. We must use the word Intelligence for all phases of it from mitron to man, but we must keep in mind always that "mitron," "man," and "Intelligence" are the same thing. The physicist suggests that his waves, which result in definite impressions on our senses, are but waves of probability having no material basis. If one can swallow this camel, there need be no straining at the gnat of Intelligence.

Primitive Intelligence in movement—that is, the mitron—is extremely simple, and some difficulty may be found in realizing that the intelligence of man has arisen from anything so infinitesimal; but it has been shown that man's body, your body, has not only arisen from one cell almost as lowly, but that your own living body does actually consist of such cells. And if your body has developed from such a lowly origin during your own short life, you cannot logically refuse to acknowledge that your intelligence has, or can have, developed in the same way from the same origin. In the mitron, intelligence is commensurate with its own primitive nature, for of what use would be the intelligence of a Socrates to such a fundamental particle?

Now, a word of caution. This primitive moving particle which is here called a mitron is only a mental deduction, just as the photon, electron, proton, quantum, etc., are mental deductions; but, while there is indirect evidence for these latter which makes their existence highly probable, there is as yet not the slightest evidence for the existence of the mitron. It is purely imaginary and its existence is assumed only to point the argument that all the phenomena of the universe may be reasonably and fully accounted for without the necessity of calling upon any interference from a source outside the natural universe. The mitron is therefore not really essential to our theme; our argument is quite independent of it, it only rounds off the beginning of things—of the universe and man—instead of leaving an unaccountable void into which vain and fearful men may spring and wave the banners of fantastic and illogical divinities.

In justification of our deduction, however, we may ask: If there is no mitron, what lies beyond the electron and the proton, the photon and the wave? For unless these were specially created they must have had an origin more primitive, more rudimentary, than themselves—and is not this mitron as, or more, reasonable than any other origin? True, one physicist "has measured the charge on the electron and has *proved* that smaller units of charge do not exist in Nature." But we feel compelled to assume the mitron, or something like it, as the simplest thing possible, and we have shown how it would to some extent account for the origin of space, time, memory, matter, strain, environment, to be followed by other physical phenomena. But, we repeat, there is no tangible evidence for the actual existence of mitrons, though we assume they do exist—tentatively. . . .

These mitrons are wonderful little things, because in them lie all the phenomena of the universe; perhaps it would be safer to say, all the thinkable phenomena. For in their refusal to stay in one position or to limit themselves to the same unmeasurable extension and duration of the common herd, they create *our* space and time, as well as light, gravity, electricity, magnetism, heat, and all sorts of such things—

but not, of course, in that sequence. Thus all phenomena consist of different expressions and relationships of this fundamental reality, the mitron, and it may prove to have a complexity of movement beyond all human mathematics and physics to explain.

Memory has been mentioned. Is it absurd that this mitron should have memory? Before replying, consider what would happen should memory be lost—completely. You would not know anything—what light was, whether fire would burn, that a window was solid and you could not pass through it, the meaning of walls, ceiling, doors, food, clothes, the constitution of sky, sea, or wind. You would know nothing because everything would have to be experienced anew by the senses every time anything happened to you. You would be afraid to move because you would not know what to do next; only involuntary motions —breathing, seeing, hearing, etc.—would remain to you. Indeed, if memory ceased you would be virtually dead, for even each thought would be a new one and would disappear immediately the incident which caused it ended. These are but a few of the difficulties in connection with total loss of memory.

Applying this to the mitron, how could it continue to move unless it had memory? Action cannot take place and then be *followed* by the Intelligence which caused it. The mitron is Intelligence in motion and would not know how to move if it lost the knowledge of movement. To say that it must obey laws of some kind is to shirk the issue, because this assumes laws exterior to substance, which, as will be shown later, is, to say the least, highly improbable. But if the mitron has a knowledge of movement it has the memory of movement—without memory the knowledge would disappear. In some way or other, then, it must possess something akin to what we know as memory. Eventually we shall have to admit that memory is one of the fundamental, and one of the most important, factors of existence.

IV

It is generally understood that matter and all that arises from it obey certain Natural Laws, but an inquiry into the circumstances of existence drives us to the conclusion that these Laws are not rigid compulsions—they are only descriptions of the ways in which things act and behave. It is not that things *must* behave in a predestined manner, but that they *choose* to behave in uniform ways. A primitive Natural Law, therefore, is a combined mitronic action, and has no existence apart from this. All forces, being created by mitronic action, have no independent existence any more than the flame of a candle exists apart from the candle. If a great many mitrons did not choose to follow similar paths there would be no "laws," and no matter, nebulæ, stars, planets, or living organisms.

The scientist or philosopher may be able to demonstrate a broken link in this chain which stretches from mitron to man, and may show clearly how and where something more simple, probable, logical, natural, or real than Intelligence has entered and controlled all the phenomena of the universe and has caused that remarkable development from primitive substance to mankind which is at once the marvel and the mystery of the ages. But for our purpose we assume the universe to consist of mitrons, and by no stretch of imagination can we conceive anything outside it. Try to think of this; the effort leads constantly to a blank where even "nothing" loses its meaning. And in this universe must exist Intelligence and all the factors that have led to matter, molecule, life, man and to the human brain.

For suppose primitive substance was without Intelligence. Why, how, and when could it have entered into atoms or organisms? On this supposition they existed before Intelligence and carried on their actions and reactions in relation to the conditions of their environment without it. Why, then, was it introduced and what change in function could follow from such introduction? How could change take place in atoms when they were carrying out their functions perfectly already? Yet how could anything be introduced *without* causing a change? Whence came the Intelligence thus introduced, seeing that the universe was already full of particles, mitrons, or matter? Why was it introduced unless a change of some kind was intended? We find no satisfactory reply to these questions, so again we conclude that Intelligence in motion existed from the beginning, that it is in everything, that it controls everything, that it *is* everything, as we have already decided.

It seems ridiculous to say there is Intelligence in the wall-paper, in the glass of the window, in the ashes of the hearth, in the flame of the lamp. Yet all these are composed of atoms, and have clear definite relationships which can only be the result of internal organization. And if we assert that there is no such thing as Intelligence of this kind, the fact that you are reading this is a direct and unqualified denial of that assertion, for your Intelligence would cease if your constituent atoms ceased to operate intelligently.

While the known facts concerning the atom are sufficient proof of its existence, our imaginary mitron is not demonstrable at present by any known methods—and it probably never will be because of its infinitesimal nature, hence its existence may quite reasonably be doubted or denied. But, if so, some other explanation of the development of the atom from primitive substance will eventually need to be assumed or discovered, and this will no doubt occur in the near future owing to the rapid advance of knowledge in this field. Such discovery may make the mitron look absurd, yet we do not wince. We do not assert its existence; we do definitely assert the existence of an Intelligence which is the basis and origin of atoms and whatever preceded them. If the mitron is plausible that is all we are concerned about. If it eventually proves to contain a modicum of truth, we shall be very proud. If it must give way to some idea which is more reasonably probable, more provable, we shall be very glad, for then we shall possess a greater truth, and that is all you and we care about.

There are many books which describe the atom together with its attributes and its construction. We add only its Intelligence, its memory, and those other methods of expression which are found in the mitrons of which we here assume the atom to be composed.

V

To sum up, we imagine that in the beginning the sequence of events was somewhat as follows :—

Homogeneity is quite unthinkable.
Heterogeneity is less unthinkable than homogeneity.
Heterogeneity implies individual particles.
These particles form the matrix of the universe. They involve extension and duration.
No phenomena can occur without motion. Particles are therefore in motion.
The motion of particles is the fastest speed in the universe; it must be faster than light.
The motion of particles is probably vibrational or oscillatory.

Constant motion along definite lines cannot produce change.
Change is produced only by particles in erratic movement.
Particles in erratic movement we call mitrons.
All particles are potentially mitrons.
Particles cannot become erratic in their movements without an impulse.
This impulse can originate only internally, an external origin being unthinkable. This impulse is Intelligence.
Intelligence and particles are the same thing, and mitrons are Intelligence in movement.
The erratic movements of mitrons consist of change in position.
Mitrons will collide with particles, thus causing some sort of strain.
Mitrons will collide with each other and may associate together if their direction of motion coincides; or may combine to form a resultant; or may take different directions after colliding.
The collision between mitrons produces greater irregularities with greater energy together with greater Intelligence if their energies are united.
The collision of mitrons results in reduced speeds.
Resultants which collide with other resultants form more complex combinations.
When mitrons or resultants do not combine they form the environment of each other.
Environment is the first product of the movement of Intelligence.
Environment limits the freedom of action of mitrons and resultants.

So matter, as we know it, may have originated.

There may be a sorting out of resultants, those going in the same direction finding it easier to travel together, as they will then collide less often with particles or with other resultants. When many are thus travelling together they are less likely to seek other paths; they seek to attain and maintain this association which means harmony, and their unified action approaches what is known as a "law."

The most consistent law is that of the limited motion of particles before mitrons came into existence.

VI

Now, the movement of mitrons must induce a strain in the matrix of immobile particles. This strain is carried through this heterogenic matrix with diminishing effect, but there are no means, and never can be any means, of observing the matrix; as it is without movement, it has only motion or vibration relative to itself—a tremulous but immobile universe, and the mitron and all that arises from it has a coarser nature, due to movement, than the particles which form the matrix; therefore the mitron is unable to detect anything finer than itself. We, being mitronic in our fundamental composition, are under the same disability, and no matter what instruments we devise we can never observe the matrix of the universe, these instruments themselves being made of atoms. It appears then that mitrons move in space without any intervening medium, though actually they move in the matrix of ever-unobservable particles, so that the determination to follow an individual line of action means a difference of motion relative to other particles.

As there is no such phenomenon as space apart from the mitron and its movement, it follows that if a mitron moves relative to the matrix it must induce a strain on both itself and the matrix because one mitron cannot separate itself entirely from the matrix, inasmuch as this would create a void of something other than space, and this is impossible.

The strains caused by the mitrons traverse the matrix and twist it out of shape until they are cancelled by other mitrons moving in a direction opposite to that of previous ones. The mitron can move only if the particles are capable of distortion and of reassuming their original forms when the strain is removed—that is, they are perfectly elastic. These strains will be small when the universe consists only of mitrons and the matrix; but when the mitrons gather into countless myriads and move in one direction, the strains on the matrix will be enormous and drags and twists of millions of miles will be frequent, yet the strains will always be attempting to right themselves in the endeavour to attain equilibrium, to achieve harmony

We see that we have arrived at Intelligence, particles, mitrons (which look suspiciously like matter), memory, elasticity, strains (can these be the forerunners of gravity ?), all by the simple process of tracing the human body with its Intelligence to its rational origin.

There can be no forces apart from mitrons, all forces being the result, near or remote, of their movements. The strains on the matrix are reactions due to the movement of mitrons and their combinations, and these strains result in an endeavour to regain the equilibrium which has been disturbed. Forces which seem to be external to the mitrons are resultants of their collision, cohesion, or co-operation. Groups acting collectively have a collective effect causing greater disturbances around them which induce greater strains in the matrix, and this exertion of collective force may seem to be something different from the force of a single mitron, but on analysis it proves to be only the result of the associated effects of the group.

As the mitron has always been in existence, so also have the phenomena accompanying it. But these are so minute that their expression in relation to a single mitron is negligible. Contact, collision, co-ordination, cohesion, collaboration, emphasize the effects of these phenomena which become exaggerated and new phenomena arise out of their complexities—and so the atomic universe appears. Any sort of contact, collision, or combination must have a resultant of some kind, otherwise something comes into or goes out of existence. A restriction of any kind must have the same result.

But, as mitrons create an environment by their contactings and collaborations, so they become limited in their movements and cannot then move with their original freedom; free will becomes limited and these specialized mitrons eventually become grouped more and more until they form what we know as matter. Disintegration of matter enables them to regain their freedom.

VII

Does it all sound fantastic? You say: "Yes!" Very well, we will examine a few facts—real, scientific facts. We are informed by physicists that space was created and time was created. We are so far from these beginnings that we are as yet unable to tell which was created first, but the mathematician can no doubt supply a formula for this. Anyway, they are created, and they take such a fancy to one another that they decide to form a co-partnership scheme, space-time. The classical physicist was not aware of this scheme and considered space and time to be quite distinct.

The modern physicist is naturally more up-to-date, so he combines them.

A particle of matter possessing neither time nor space is then created somewhere or other and inserted into space and time. Apparently matter has no mind where space and time are concerned, but must just respond without cavil or remonstrance to their " laws." What these laws of space and time actually consist of in themselves no mathematician will tell us, but to the common mind it is difficult to imagine empty space and empty time having laws at all in the absence of matter. How and where the laws are situated in space and time and how they compel matter to obey them is wrapped in mystery.

Gravity is then created somewhere, or nowhere, and hooked on to the particle of matter, and this, too, miraculously conforms to the dictatorship of the laws of time and space. Some electro-magnetism and a few thermodynamics are then created and are added to the burden carried by this bit of matter, but all these new phenomena or forces are subject to the laws of space and time, as well as to their own particular laws.

Of course, this bit of created matter is nothing like a marble or a grain of sand. It consists, nowadays, of waves and quanta. We should like to imagine it being given a push and then starting off with its load of properties and laws, doing all sorts of things, becoming nebulæ, stars, planets, forming chemical combinations, building up protoplasms, evolving the existing races of mankind. But we must not imagine these things occurring because of the *movement* of this particle of matter. When it is first created it has no movement, and the laws of space and time and motion and gravity and electricity and magnetism pounce upon it before it has time to do anything, and it seems that all these laws must have been applied to it at the moment of its birth. Any idea of it doing anything or even existing without its load of attributes would bring a shock to the soul, if any, of any self-respecting physicist.

Now, is such a beginning rational ? What are the chances of laws being created independently by something, somehow, somewhere, somewhen, and all fitting in so beautifully to control matter ? Here is a really attractive problem for the mathematician.

The fact of the matter is that these laws are man-made. They are the products of imagination, based on the observation that certain events usually happen in certain ways and usually follow certain antecedent events. One of the simplest of these is that the sun will probably rise to-morrow morning. But this does not *prove* that these events *must* happen; as a general *rule* they do so happen, but there is no compelling law that they must do so. Even if we admitted such a law it must be a changing one, because the universe is constantly changing and all laws must change with it. If these laws have an independent existence what would happen to them if there were no particles of matter? They would still exist, presumably, but how and where, and what would they do? Would they just float about in space and time or in a space-time continuum—that is, in a part of themselves—doing nothing until they captured a particle on which to exercise their forces?

A word about gravity as an example. If gravity has a law which matter is compelled to obey, it must be external to matter. Its function is to cause particles of matter to attract each other, but how does it exercise this function? What is the method or the means of this attraction across space, and how is it passed or conveyed from one particle of matter to another? How and where does it exist and in what form? Is it called into independent existence by some power as soon as a bit of matter comes into existence?

The scientist will doubtless reply that these questions are nonsensical. Gravity is a "property" of matter. But if so then it must be within matter. Matter cannot have properties which are apart from it, outside it; it may choose to act in certain ways, and if sufficient particles act in the same way, that way will be the usual one and may for convenience be called the "law" of that particular way, but the meaning of the word "law" should be clearly defined in order to avoid misunderstanding.

How do these external laws affect the mitron? What *external* force or law *can* there be to compel the mitron to move along *previously* defined paths—a law which the mitron *must* obey? How can there be a law concerning the mitron which is *apart* from it? Would not such a law again introduce that impossible external interference? If there is any law at all it must exist within the mitron.

VIII

Again, a law, either within or apart from the mitron, could not operate on one mitron—two or more would be necessary to produce any effect. This means that it is dormant or non-existent until two mitrons appear, but how can there be a law which begins to operate only as and when the things it influences come into existence? It must be ready and waiting for this moment, or when two mitrons appear it, also, must be created. In the former event it must have had some state of existence quite different from that of mitrons, and had the latter never appeared it would presumably have remained in that state always, ready and waiting for something that never happened. In the latter event, all its powers must have been bestowed on it the instant two mitrons came into existence.

Do such laws possess Intelligence or not? If they do, such Intelligence will be without any material basis, yet it will guide and control matter which is external to it and with which it has no actual contact. How this control is exercised should be explained by those who are of this opinion. Are the laws self-existent? If so, did they create themselves, or how did they come into existence as separate activities? And why so many? If *not* self-existent, how did they come into existence and how did they obtain their powers over matter? Why did they trouble about matter at all if they existed without it? Or did they create matter for their own amusement or as something on which to exercise their powers? If these laws are *not* intelligent, by what means can they control matter and how can they direct it into logical ways and methods of behaviour? How can Intelligence of any kind arise in a world controlled by non-intelligent laws?

We find no satisfactory answer to these questions and they are asked only in order to get clear the relationship between "laws" and the mitrons which are the source of matter and all its actions. But if these questions can be answered to the full satisfaction of reasonable unprejudiced men, we shall be very pleased, because it will bring the truth we are seeking so much nearer. Until then we must dismiss the notion of laws apart from mitrons, and laws within mitrons, as equally inconceivable. Quite apart from the mitron, the foregoing argument applies equally well to laws in relation to any other hypothetical substance from which the scientific atom may be derived.

Laws, therefore, have no existence in themselves. They are only descriptions of the way in which mitrons behave, and it is this behaviour which produces all the forms and laws of what we call material things. If law is thus understood, it is very useful, and indeed essential to the understanding of phenomena, but if anything is added to it—anything apart from the collective behaviour of mitrons—it will almost certainly lead to error in the search for reality.

We conclude that no law compels the mitron, which is Intelligence, to act as it does; it is its own free will or free choice that induces it to do so. And as most mitrons will be actuated by the same impulses or motives, there will be a general tendency for them to follow the same paths. If all followed the same paths exactly, there would be no change and hence no matter; but some do not, and it is these which form the basis of the material universe. It may be that at some time or other *all* mitrons occasionally move out of their regular paths, or, more likely, that *some* definitely refuse to follow the regular paths. We say more likely because when a mitron exercises its free will—i.e., when Intelligence moves—it takes on those movements that eventually result in the evolution of matter, whereas if all of them moved on occasion this would result in them *all* becoming matter unless in some way they changed back again from matter to mitron, and the phenomena of matter, mitron, and matrix make this difficult to imagine.

The following method may be suggested to account for the attraction of matter. A group of mitrons causes a strain in the elastic matrix—a drag or twist which distorts it. This distortion endeavours to right itself, and can only do so by compelling the group to return to its original place and position. But the group carries on, and contacts or combines with other groups which increase the strain. Enormous masses of mitrons are formed, and the matrix is subject to enormous strains which constantly endeavour to restore equilibrium. Groups such as planets, stars, clusters of stars, great nebulæ, result in the greatest strains of all, and the nearer these groups are to each other, the more local and the greater the immediate strains become. Hence the greater tendency for adjacent or compound strains to bring the groups together, the tendency having relation to the number of mitrons in the group and the distances of the groups from each other. Superficially, it would appear that the groups have an attraction for one another; actually, they are, as groups, independent of one another, and only the strains arising in the matrix due to their movement prevent them from becoming entirely free. This seems to be the way mitrons and strains mutually behave, if there are such things, and any " laws " formulated in relation to them would be subject to this; but such laws would be descriptive of the action of Intelligence in motion and would not be compulsions exterior to it. And space and time would be consequent on the action of mitrons and strains; if all the mitrons returned to their original condition the strains would cease and space and time would disappear. Incidentally, whatever "force" may appear in connection with this behaviour of mitrons and matrix is not in the mitrons alone but consists also of a reaction of the matrix to the movement of the mitrons.

It may be said that our universe is an enormous structure to have arisen from comparatively few mitrons. But compare the whole of space to the amount of "solid" matter in it and one will get some idea of how very few mitrons, relatively, were necessary to form the universe. The whole of the actual matter in the human body is so infinitesimal that it cannot be seen with the naked eye; a ton of it can easily be contained in a matchbox, so the physicists say.

To return to law. If all the mitrons in the universe decided on a common action, then that would be a perfect "natural law" so long as the action lasted. If half the mitrons decided on a certain action, and the other half decided on an opposite action, no law would result—either nothing would happen or perhaps they would annihilate each other—that is, they would all return to the non-erratic condition. If a large number—say 999 out of every 1000—decided on an action and the odd one decided on an opposite action, a *rule*, but not a law, would follow. This is the usual state of all things.

If great groups or masses of mitrons did not choose to follow the same paths, to keep together, there would be no physical "laws" and no matter, no nebulæ, stars, planets, organic matter. The universe was never in a chaotic condition; order could never have developed from chaos unless by interference from an external power—the same power that created the chaos—unless one assumes an uncreated chaos and this power taking upon itself to step in and put it right, which is unlikely. But there is no regularity—hence no law—in connection with natural events until new ways of Intelligence have been often repeated and become fixed.

If we reject the development of the universe from this primitive particle by means of its own Intelligence we must accept the separate creation of matter, motion, space, time, gravity, heat, light, sound, electricity, magnetism, chemical action, inertia, with all their several and combined laws uniting together not so much by some sort of accident but by a most marvellous series of miracles which enables them to adjust their own attributes and laws to those of all the others and work in perfect harmony together. Even so, none of them can be completely isolated from the others; they act as though they are phases of one fundamental unity; and, as these phases constitute the thing itself, it would not surprise us if this unity proved to be based on the mitron after all!

It is very difficult to estimate the degree of Intelligence in the fine structure of matter, but, if we admit there *is* Intelligence of some kind and examine matter and its changes and actions on this basis, we may find interpretations that are impossible on a basis of non-Intelligence. Is it not therefore more reasonable, more logical, to assume one universal basic substance, with some of its particles—induced by the Intelligence of which they consist—moving differently from the mass of their fellows, and by a spreading series of collisions and combinations forming a gradually developing universe? We think so, and on this assumption this book is written.

IX

It is said that the universe is a mathematical one, one which lends itself to measurement, and this is true—is, indeed, essential. If it were not so it would be timeless and spaceless, and nothing in the nature of physics, chemistry, organic form, could exist. They appear only because the mitrons associate themselves in certain ways and movements in relation to one another in order to attain harmony. In the beginning movements were very simple, so were mathematics, for mathematics, as yet unmeasured, existed and grew side by side with the increasing complexity of the movements and associations of the mitrons. The physicist discovers these movements and associations and the mathematician invents formulæ to symbolize them; he demonstrates mathematics, the mitron acts mathematics. As measurement, mathematics developed with the increasing complexity of the movement and associations of mitrons. The foundations of mathematics probably lie in the degree of the irregularity of the mitronic movements. A particle may decide to act in a regular manner and then may get tired of it and start off on its own account, which means that every particle has free will and may assert it at any time. Those which associate together or which act in regular ways may have mathematics applied to them and formulæ may be constructed for their movements, but the free mitrons, or those which break away and become free, cannot be brought under any formulæ whatever.

The more fixed in their ways the mitrons become, the more they observe restricted paths, until at length they become so stabilized that they rarely depart from them. To these, mathematics may be applied confidently, for this is "matter." Although restriction means a loss of free will, there is an advantage in combined association and movement, as this lessens the contactings and the resulting irritability, if such a term may be used for so slight an effect. At the same time, however, the greater these associations and movements, the greater the strain on the matrix.

The approach to primitive substance through mathematics produced the sun-and-planet atom. The approach through imagination produces free wave-like Intelligence in motion—the mitron. Mathematics holds the field and may always do so, but there is an æsthetic pleasure in letting imagination swing a little—and mathematics may eventually become the servant of imagination.

Methods and means and instruments which have been invented by man for economy of thought or as a means of obtaining greater knowledge or of more complete explanations of phenomena, have little or nothing to do with the reality of things. It is experience and understanding that must determine ultimate reality so far as it is amenable to understanding, or to having any meaning that can be understood. Thus, no instrument, no mathematics, no reasoning, can take the place of fact, reality, and truth. But such means may be of enormous value in ascertaining these things, and by their aid the basis of knowledge may be broadened vastly, and new interpretations may enable the limitless horizon of fact and truth to be brought nearer. Instruments and methods are the servants of the understanding, but have no control or mastery over it. It is reducing mathematics to an absurdity to suggest that mathematics is an integral part of the universe apart from the human brain; it seems that the mathematican may create any sort of world he pleases, but the criterion of the truth of such worlds is human experience of fact, and so far as facts and truth are concerned, mathematics is in no way creative.

In the meantime, we learn that "Relativity Theory has not succeeded in furnishing an explanation of gravitation that will command general agreement; nor an acceptable substitute for the hypothesis of a physical ether." And the greatest authority on Relativity remarks : " Our only way out seems to be to *take for granted* the *fact* that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the *meaning* of this statement." It may also be noted that " Because the physicist cannot determine with certainty both the position and velocity of an electron at any instant—since his means of observation do not allow him to do so, and from their nature can never allow him to do so—this school deduce from this that the electron itself shares the uncertainty of the physicist." We are also interested by the following : " Recent theoretical views suggest that a mechanist view of Nature cannot be pushed beyond a certain point, and that the fundamental laws can only be expressed in abstract terms, defying all attempts at an intelligible description." The foregoing opinions encourage us to believe that our mitron need not hide its head with shame at the problematical nature of its origin and being.

But should these quotations seem to belittle the importance of the mathematician, let us hasten to point out that his mind moves perhaps on a different plane from that of the common mind—of ours, and yours, dare we say ?—and these things which puzzle us may have quite different meanings for him, meanings which may eventually be made plain to us and which may enable us to understand what is at present inexplicable; to understand, for instance, what real limitations there are to our universe and what exists outside the space and time created by movement. Indeed, perhaps some day he may endeavour to mathematize and explain the mitron, if he pays any attention to it at all, and we should be filled with awe, mingled with admiration, if we could observe our learned sorcerer with his geometrical hat and contractile measuring-rod, singing his surds and conning his calculi as he paced solemnly round and round his mathematical tripos, throwing on a log. or two or a few roots of minus one when the fires of inspiration burned low.

CHAPTER XVI

ATOMS

I

THE whole universe seems to be a restless, seething swarm of atoms each bustling about its business; rushing towards a friend here, avoiding a foe there; twisting, turning, dancing; grouping together for a second or a century, separating for a moment or a millennium; but always in rapid motion from the eternity of the past to the eternity of the future. There attenuated into vapour, here compacted into platinum; there gathered into the infinite complexity of a human being, here splitting up into the infinitesimal simplicity of a mitron; there amassed under the influence of a seemingly inexorable law, here disseminated into a seemingly whimsical irresponsible anarchy.

Let us look a little closer at this atom which seems to be the only really stable thing we have so far noticed, yet which is known only by its effects. Its internal structure is being investigated in a thousand laboratories, and the records of these investigations would fill more than a thousand volumes. The actual development of the various forms of atoms need not detain us because we are dealing only with the bearing of Intelligence on the fundamental changes leading to the development of man, and when a basic change has been considered, the development between one change and another, between one epoch and another, is to be found in the text-books.

Accepting the present general opinion, the active atom consists of a central nucleus with one or more particles in rapid motion around it. From such atoms all the elements of matter are formed. There are ninety-two elements, their structures varying from an atom with one proton in the nucleus and one electron flying round it, which is the element hydrogen, to an atom with ninety-two protons in the nucleus and ninety-two electrons flying around it, together with 146 neutrons which are massed in the nucleus with the ninety-two protons; this is the element uranium.

The electrons, which are the particles referred to, fly around the nucleus in orbits of comparatively enormous size. One suggested analogy is to imagine a pin-point of matter suspended in the middle of a vast building with a number of minute midges flying along the roof and sides and floor,

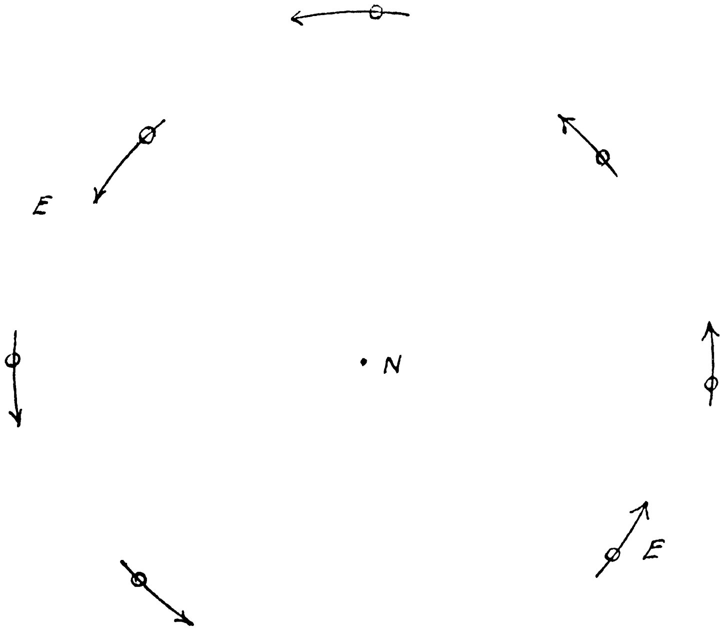


FIG. 3.—Scientific atom. Consists of nucleus, N, containing protons and neutrons, with electrons, E, moving in orbits round the nucleus. A proton is 1835 times as heavy as an electron, but the whole nucleus is smaller than one electron. The electrons fly round the nucleus ten million million million times a second and their speed approximates to the speed of light (186,000 miles a second).

some flying at one distance from the pin-point of matter, others at other distances, some flying in circles, others in ellipses. The building as a whole represents the atom, but it will have no floor or sides or roof, only this speck of matter —the proton—suspended in the middle of the space and the midges, the electrons, flying round and about it, nothing else, and the midges flying almost as fast as light (see Fig. 3).

Of such is the universe made, together with all that is in it—air, stones, grass, men, ourselves as we write this, you as you read it.

The discovery that the radium atom constantly gave off rays, thereby changing from radium into lead and helium, resulted in the theory of radio-activity, and in the inference that electrical action could take place within the atom. The atom was therefore not indivisible as hitherto supposed, but apparently had some sort of structure. Scientific research into the nature of the atom followed this discovery; progress has been remarkable and the understanding of the foundations of the universe has been profoundly changed in consequence.

In order to discover its structure, the atom has been bombarded with certain projectiles in an effort to break it up. This has met with astonishing success. The projectiles consist of alpha (α) particles, which are the *nuclei* of helium atoms, beta (β) particles, which are electrons, gamma (γ) rays, which are X-rays, and neutrons—which have not yet achieved the dignity of a letter of the Greek alphabet—consisting apparently of a proton and an electron in intimate union. Helium nuclei and neutrons, being heavier than the other projectiles, are the most effective. They are being directed against the atom under voltages exceeding 10,000,000.

When a projectile strikes the nucleus of an atom, it enters and its energy is dissipated amongst the protons and neutrons of the nucleus. This causes considerable disturbance, and in some manner the nucleus either assimilates the incoming particle or it re-forms itself and expels another particle, either an electron, a proton, or a photon, or perhaps a quantum of energy which is none of these, the final result being that the original atom has changed its constitution.

This bombardment is an artificial action and the results must be considered in that light. Nature builds up one way, man destroys in another; possibly the two are counterparts of each other, but this is unlikely because destruction is violent and disruptive and does not return along the patient ways by which things have travelled to their natural existing conditions. In this event what knowledge can be obtained of the real anatomy and functions of the "living" atom by disintegrating it so violently? This disintegration is obviously abnormal, and is it possible to reconstruct the growth and development of an atom from the results of its destruction under abnormal conditions? Are we to discover the design, the construction, the architecture, the materials, the carving, the building, the manual skill, above all the Intelligence, involved in the erection of a noble cathedral from the manner in which it is blown to pieces? May it not be more satisfactory to use our reasoned imagination in the endeavour to trace the origin, construction, and development of any form of existing matter from its sources and then put the results to the test of observation, rather than to base all our conclusions on destruction only? We should therefore exercise caution in drawing conclusions about natural phenomena from laboratory experiments. For instance, in the laboratory nitrogen can be converted to oxygen by bombarding it with helium nuclei; if such a bombardment happened in nature, no nitrogen would exist and organic matter could never have arisen. But we must keep in mind that it is this artificial disintegration of the atom that has given us all the information we possess about its construction and has feathered the wings of imagination by opening up a new brilliant universe of knowledge.

II

Here we may ask: Are the constitution of the atom and the results which follow its bombardment quite without Intelligence? We have mentioned Natural Law, and find this to be a method of describing the way in which matter acts; it cannot compel matter to act in the way it does, it only records the way according to human observation. In the bombardment of the atom no law has yet been formulated with regard to what happens. But the absorption of the helium nucleus and the subsequent expulsion of something which, generally, is not a helium nucleus must mean some definite rearrangement of internal structure. It cannot be pure chance; *it is a new experience* for the atom to be treated in such a manner; it is not completely disintegrated, yet it adjusts itself to this obviously indigestible intrusion and makes a desperate effort to recover harmony by a rearrangement of the particles of the nucleus, and it continues its existence in another organized form.

Can all this be quite without any sort of Intelligence? If so, how is this rearrangement brought about by an action or reorganization that has never before been called upon to express itself during the whole history of the universe from the first movement of the mitron to the man who is responsible for this bombardment? This disintegration of the atom approaches our theme very closely, and we would like to know what is really going on inside the atom; to discover, if possible, if and how Intelligence operates in the atom and if any intermediate form of substance exists or ever existed between mitron and atom; whether the splitting of the atom will reveal something of the nature of the mitron; whether the disturbances following the intrusion of the bombarding particle and the extrusion of the ejected particle consist of a rearrangement of the nuclear particles, with the mitron—Intelligence in motion—as a basis of the energies involved.

This pre-atomic, this primitive, existence is that which the physicist has recently discovered and demonstrated and which he is investigating and experimenting on every day. It is a world of particles—of electrons, positrons, protons, neutrons, photons, mesotrons, neutrinos, quanta. Only the investigator into pre-atomic physics will be able to discover the state of matter between the mitron and these particles, if it exists at all. But the physicist may say there is no such state; he may be able to prove that such a state cannot exist. Indeed "The great idea which Einstein contributed to scientific philosophy was the principle that if a thing is essentially unobservable then it is not a real thing and our theories must not include it," which makes the mitron shrivel up to nothing. But another authority says: "Einstein's 'great idea' . . . is so inherently idiotic that I cannot understand anyone wasting his breath in giving utterance to such a view," which encourages us to continue. So let us look at the conditions of existence as demonstrated by the physicist if he declares that a transition from the mitron to these particles is impossible.

Were the phenomena of existence—matter, motion, electricity, magnetism, gravity, heat—always existing, or were they created out of nothing or out of some more primitive substance than themselves? If created they must have been created either simultaneously or in some sort of succession. But if created in succession, how could some of them exist without the others? If created simultaneously, then there must have been one complicated creation, or else the phenomena are all the results and sub-results of one effort. If always in existence, did they always exist in their present form or condition? If so they are for ever inexplicable, and it would be a waste of time and mental effort to dwell on their origin. If they did not always exist in their present form and condition, from what did they arise and what change took place between their previous and their present form? And was the previous form an original one, or did that also derive from a form preceding itself? Do we get any satisfaction from examining into this method of origin which seems to lead nowhere? Apparently these particles of the physicist must have had no beginning; they must have been always as they are no matter how they may unite to produce an atom. This means that the universe never had a beginning—that is reasonably possible so far as man's thought is able to dwell on a beginning—and according to present theory these primitive substances always existed in their distinct individualities, electron, proton, photon, neutron, positron, all distinct entities.

But how did they become linked together? Why is the electron as powerful electrically as the proton although the proton is 1,835 times heavier than the electron? What caused this? Did it just happen? Is it possible that this electrical association is a pure accident; that the negative electricity of an independent electron balanced with the positive electricity of a proton just by chance? Hardly! Then how did it come about? Why does the electron connect electrically with the proton and enter into electrical balance with it at any distance of orbit? And how do they combine to form a neutron, if they do so combine? Or, if they were originally combined, how did they separate? What relation is there between the proton and the inner and outer electrons that enables the protons, which are all compacted in the nucleus, to balance with these electrons whose distances from the nucleus differ, relatively, so enormously? And, remember, the size of the *whole* of the crowded nucleus—containing ninety-two protons and 146 neutrons in uranium—is stated to be no larger than a *single* electron, though each neutron may contain an electron!

III

How do all these associations, electrical charges, combinations, and expulsions arise? Apparently these primitive substances have always been like this and ever will be, and the meaning of it evades us. Is it reasonable to assert that the universe began in this manner; that these several utterly different kinds of particles just occurred and then by some wonderful chance began to link up together, adapting themselves to each other's peculiarities, balancing with each other though their weights differ so enormously, producing in the process of association those remarkable effects of light, electricity, rays, and building up atoms according to a Periodic Law—all without Intelligence, without any sort of control ?

Is it not more reasonable to assume a more primitive state of substance from which all these were derived in a logical and methodical manner under some sort of guidance? Obviously, we ourselves think this to be the more reasonable process of development, and if this principle be adopted as a working hypothesis, possibly some of the puzzling results of research would fall into line with each other and their relationships would be easier to follow.

We have already mentioned that we think atomic movement is an impulse, an oscillating or harmonic motion, a flowing backwards and forwards in many directions. One physicist says the molecule has internal movements and when these are excited it emits rays, the wave-length of which is a measure of the time of vibration of the molecule. This seems to confirm scientifically the opinion held here that the vibratory principle is the basis of motion.

Another physicist " assumes the gradual formation of chemical elements due to the action of three forms of energy —electricity, chemism, and temperature—on the ' formless mist ' (protyle) wherein all matter was in a pre-atomic stage—potential rather than actual. In this scheme the chemical elements owe their stability to a sort of natural selection, those of lowest atomic weight being formed first, then those of intermediate weight, and finally the atoms with the highest atomic weights, such as thorium and uranium. The next step is the formation of compounds, the dissociation of which is within the powers of our terrestrial sources of heat. Radium does actually and spontaneously dissociate." This implies some form of energy apart from substance of any kind. Our mitrons are surely more rational than this, for here we find substance (protyle) without any basis of existence, and also three forms of energy independently existing without any basis of matter. How can electricity, temperature, chemism, exist without matter of some form ? What can be the state of such existence ? We know that energy can be transformed into matter, but in this suggested state of existence the only matter is protyle, and if the three energies, or any one of them, were transformed into matter, how could this affect the condition between the energies and the protyle ? Again, these energies must be in existence somewhere ready to seize a bit of protyle which has no energy, but . . . where can there be such existence? This puzzles us. From the foregoing scientific opinions it will be seen that we err in good company when we prefer our vibrational mitron to an orbital atom.

The mathematics of the orbital atom need not deter us from making suggestions about atomic structure that seem more mentally satisfying, because if such suggestions proved to be true, mathematicians would at once discard their previous proofs and would prove the correctness of the new suggestion without a shadow of hesitation or doubt. For instance, "There was just one place where the theory did not seem to work properly and that was—infinity. I think Einstein showed his greatness in the simple and drastic way in which he disposed of difficulties at infinity. He *slightly altered his equations* so as to make space at great distances bend round until it closed up." If we had the brain of an Einstein the things we could do with our mitron!

IV

On page 179 we saw that bombarding the atom results in the bombarding particle becoming absorbed into the nucleus of the atom, its energy being distributed amongst the protons and neutrons which form the nucleus. The nucleus has therefore changed, and the atom becomes a different atom because it must now be unstable, or it attains a new sort of stability with new properties. If unstable this is rapidly corrected in some measure by the ejection of a proton or an electron, or a quantum of energy, but the particle shot out is not the same as the intruding one. In spite of the packed state of the nucleus, some motion must be taking place due to the energy which is being distributed. Is this motion a definite one—circular, vibratory, or what? It is inconceivable that it is haphazard, that the particles just rattle about inside the nucleus. There must be some method in the distribution of the energy of the incoming particle—all the energy cannot be absorbed by only one particular particle—and owing to this distribution the incoming particle must go out of existence as a particle because its structure or substance must have been destroyed in being split up, probably as energy, among the nuclear particles. Is this possible? If so, this particle—proton, neutron, helium atom—must consist only of energy which can be split up among other particles, thus losing its identity—its form, its structure, its individuality. Now to our point:

Dare we suggest that this particle consists of a group of mitrons ?

Assuming some method in the distribution of the energy of the incoming particle and the motion accompanying this distribution, what is the condition of the ejected particle ? Is this a particle reconstructed from the energy of the incoming particle, or is it something already existing in the nucleus which must be thrown out on account of the surplus energy brought in—that is, because of a condition of strain in the nucleus which was not present before ? Are the particles of the nucleus just going round and round, each with its additional load of energy derived from the incoming particle ? Or are they in a state of vibration, a reciprocating motion ? However this may be, some definite organized action must occur for the purpose of ejecting a particle, and energy corresponding to that of the particle to be ejected must be accumulated in some more or less precise manner.

Is the particle ejected at a tangent to the periphery of the revolving nucleus, or do the constituents of the nucleus organize themselves so as to use their accumulated original energy to fire out the particle like a bullet, perpendicular to the periphery of the nucleus ? In the former case the energy of the ejected particle will depend on its mass, the force of its ejection, and the peripheral speed of the nucleus, assuming that all the constituents in the nucleus are revolving together in unison and that " classical " mechanics obtain in these circumstances. The original intrinsic energy of the constituents of the nucleus would have no effect on the ejected particle ; they would only give up part or the whole of the energy which each had absorbed from the bombarding particle. If, however, they decided to get rid of the surplus energy by a united effort, and, if their motion was vibratory, they would wait until they were in a position to combine all their united energies at the same instant and thereby expel violently the excess energy brought in by the incoming bombarding particle ; but this entails organized action between all the nuclear particles—they must collaborate, they must act Intelligently. If the incoming particle is disintegrated in such a manner that part of it is ejected and part remains, the atom changes its constitution—it becomes another kind of atom with different properties.

Observe that electricity comes into existence only when the electron is expelled or is detached from the atom. There is a nucleus consisting partly of neutrons—which cannot be electrified because the protons and electrons composing it cannot be separated—and partly of protons which may become electrified positively when the negative electricity, the electron, leaves or is expelled from the atom. The protons alone carry the electric charge on the nucleus, but the whole nucleus, protons and neutrons together, exhibits the electrical effect. Unless, that is, only the protons exhibit the electrical effect while the neutrons form an inert mass of particles with no action of any kind whatever and are only a dead weight on the nucleus. In the latter event, what is the difference between the condition of the hydrogen atom, which has one proton and no neutrons in the nucleus, and that of the uranium atom, which possesses ninety-two protons with a dead weight of 146 neutrons?

Let us pause for a moment to consider the speed of the electron. It is a little over 180,000 miles per second—approximating to the speed of light—and it revolves round the proton 10 million million million times a second. In a helium atom there are two electrons travelling presumably in similar orbits at the same speed. In the radium atom there are eighty-six electrons travelling in six different orbits, two in the first, eight in the second and third, eighteen in the fourth and fifth, thirty-two in the sixth. If all these electrons *travel at the same speed* as that in the hydrogen atom, then the outer electrons travelling at this speed must revolve round the nucleus a much less number of times than do the inner ones, proportionally to the diameters of their orbits. If they all revolve round the nucleus *the same number of times per second*, then the outer ones must travel at the same speed as that in the hydrogen atom and the electrons in the inner orbits must travel at progressively lower speeds, according to the diameter of their orbits; the outer ones cannot travel faster, because this would exceed the speed of light, which is impossible. The orbits are not in one flat plane but revolve in different planes in what one may imagine to be a cage-like form; and, as before mentioned, the orbits are not all circular, many being elliptical. With these different speeds, orbits, distances, and revolutions, the atoms of the heavier elements have complexities which it is impossible to imagine, and our doubts about this form of atom increase in spite of the regular numerical sequence in the number of electrons in these orbits—namely, 2×1^2, 2×2^2, 2×3^2, 2×4^2. The foregoing is only a passing comment on the difficulty of understanding the structure of the scientific orbital atom.

Again, is it chance that enables any proton to be in electrical association with any electron, or does each proton balance with its own particular electron? That is to say, if an electron is in the outer orbit, does it balance with any proton in the nucleus, or with some special proton? And similarly with electrons in other orbits. If each electron has its special proton, the protons must respond to the movements of their special electrons and the confusion inside the atoms must be terrible with all the protons moving irrespective of each other and all the electrical currents passing or interweaving with each other and the hosts of neutrons being bustled about by the lively protons and wondering, no doubt, what it is all about. But if the electrons are not attached to any particular proton, then there is electrical transfer from *each* electron to *every* proton as the electrons fly round in their several orbits, and the confusions will be worse than ever. " Lines of force " between each electron and proton must be cut countless millions of times a second. In a complex atom such as uranium there are ninety-two electrons and ninety-two protons, all with these electrical charges changing and crossing, shifting and entangling each with other, and 146 neutrons dodging about and getting in the way and throwing everything out of gear—unless they are all gathered sullenly at the centre of the atom, motionless, meaningless, morbid. But can one imagine such a structure—a mass of non-electrical inactive neutrons surrounded by ninety-two protons in violent electrical and/or physical action and away out on the horizon ninety-two electrons flying about all ways at once at different speeds, clinging in frantic devotion to one elusive proton or shifting their affections about 92,000,000,000,000,000,000 times per second as they sprint round the nucleus with the speed of lightning? And what happens in the case of the negatively electrified atom, one with an excess of electrons? Here the electrical balance of the whole atom is disturbed and presumably the surplus electron or electrons affect the whole of the other electrons and protons—resisting electrons and attracting protons—as they cannot isolate their action to already balanced single protons. If an alpha projectile enters the nucleus what happens to it in the case of an atom with eight protons and eight neutrons in its nucleus, and one with ninety-two protons and 146 neutrons in its nucleus? We wonder! . . . There seem to be a good many difficulties about this sun-and-planet atom if one endeavours to grasp what is going on inside it.

Once more, if the transition from mitron to atom is direct, then it is impossible to follow the process if the atom has a sun-and-planet structure. Such an atom has a periphery centred in the nucleus, this periphery being delineated by the outer orbit of electrons as they revolve round the nucleus. In the molecules the atoms are linked together by the peripheral electrons, some of them passing through or interweaving with each other's orbits. A space is left outside where the peripheries cross each other, but if, according to our opinion, space is created by the movement of the mitron, such a space is impossible, because it must be created or have come into existence in some manner quite apart from the mitron (see page 158). It is not created by either the mitron or the atom; it is a sort of uncreated space. It may be said that the space between the peripheries is full of mitrons or particles; if so, then the evolution of an atom from a mitron is beyond us to imagine, because a circular or orbital motion is something new in the universe.

It is evident that we do not like these orbital atoms; they do not seem right, they are too mechanical, too astronomical. True, the particles of the nucleus need not be particles in the usual sense of the word (so many words in physical science are not used in their ordinary sense that this would not be unusual)—they may be waves linked in some manner to each other within certain limits: waves curling, flowing about each other, intertwining and twisting at enormous speeds, ready at any moment with any change in the inner or outer environment to fly apart or unite with other particles, or to become independent units as quanta or photons or mitrons or what not. But nevertheless the difficulties of the orbital principle remain.

One physicist states that there must be vibratory motion in constrained paths among the molecules of a solid, and that when a single atom of matter moves it moves as a whole. If we apply this to the mitron it will have a vibratory motion and when it moves it will move as a whole, and so the mitron falls into line with scientific opinion (see also page 183).

A vibratory motion may be likened to a reciprocating shuttle in a weaving machine; it is flung from one end of its throw to the other, and at first we can easily insert a slide across this movement which will interrupt it. But if the shuttle is flung faster we shall have to be quicker with the slide, and when it becomes exceedingly fast we shall be unable to move the slide quickly enough to intercept the shuttle—the slide will strike it and rebound. To our understanding it would then seem that the shuttle was one solid piece of material from one end of its throw to the other; yet it is the same shuttle, and this solid appearance is due only to its speed relative to the comparatively slow movement of the slide. If we could move quickly enough we could still insert the slide, but the circumstances of our existence have never made such swiftness necessary, so we seem to live in a world where the shuttles of the universe seem to be solid on account of their excessive speed relative to anything we can command. We ourselves are compounded of *groups* of mitrons travelling at less speeds than are the individual mitrons in the groups; hence we, and all we perceive by means of our senses, are what we call solid because we cannot move fast enough to separate our constituent mitrons.

Assuming, as we do, that before mitrons appeared the universe consisted of vibratory but inactive particles, how did action enter into this universe of inactivity unless by free will? Something must have caused some inactive particles to become active. As this must have had an internal origin, it could not have come into existence by any law, because there could be no laws where nothing existed. Therefore, only Intelligence, exercising an indefinable and apparently incomprehensible free will, could have introduced movement—the movement of itself—into the universe, as we have before stated.

VI

Now, all the foregoing remarks may be very elementary, but, if the principle of Intelligence holds good in elementary relationships, it must also apply to the most complicated relationships possible. It may still be asserted that some external interference brings about these relationships, but to do so it must build on the foundations of the simpler ones, unless the external interference brings about the more complicated ones apart from the simpler ones. Even so, they must use the basic materials first formed by the simpler relationships. So, again, external interference is impossible to understand. One celebrated physicist says: "If, therefore, the analysis of the mechanism of living organisms could be probed as far as that of atomic phenomena one would scarcely expect to find any features differing from the properties of inorganic matter," which seems to point our argument very well. We may add that if this mechanism could be probed as far as the mitron, it would prove to have mitronic properties.

In the research into atomic structure, new experiments, new discoveries, new results, are occurring every day. We may therefore be out of date in some of our brief attempts to describe the disintegration of the atom, and some of our questions may be outside the points we have tried to make. But this will not vitiate the main argument that there is an Intelligence involved in all matter with its organizations and its actions, and that all matter ultimately consists of this Intelligence in a material form. Inasmuch as matter and energy are mutually convertible, it follows that energy also is Intelligence, and the only limitation to the action, the free will, of any form of individual Intelligence is the environment, which consists of other individual Intelligences all endeavouring to achieve harmony in their various ways. In the disintegration of the atom and the redistribution of energy, no matter by what means, we see Intelligence endeavouring in the face of an obstructive environment to readjust itself to those harmonies from which it has been so rudely displaced. For instance, " in 1901 a new star near Algol grew enormously and the spectroscope showed rapid changes and it resolved itself into a spiral nebula." Again, " This universe could not be destined to subside into a tideless sea of unavailable energy, moved by no currents, stirred by no ripple, changeless, and unchangeable. Somewhere, by some unknown process, the degraded energy must be undergoing a process of renewal and reintegration, to play its part once more in the physical world." Yet again, " in extreme modern developments of the idea of relativity, the material universe seems to have no ' foundation stones.' . . . The end of the cosmos would be the vanishing of matter : its beginnings must be on every scheme inscrutable." Yes ; but what *is* the beginning ?

And even as we write, this orbital atom and all its mathematics are being discarded and the physicists and mathematicians are busy demonstrating and proving another structure of the atom. The mitron carries on, though we freely admit there is no evidence for its existence. But though physicist and mathematician may prove its nonexistence, this will not affect our argument in the least. What we desire to show is, first, the improbability of any external interference with the substance of which the universe and its manifestations are composed, and, second, the improbability of substance existing or acting without Intelligence. Therefore in order to refute the argument it would be necessary to prove that there can be, and is, some power external to the substance of the universe which interferes with the affairs of the universe and to indicate by producing incontrovertible evidence when and where such interference takes place. It must also be shown that action—pre-atomic, atomic, molecular, organic—can take place without any sort of Intelligence, which means without order or logical sequence. And there is the further responsibility of accounting for the Intelligence we and the animals possess and of showing how, when, and where it originated in the process of organic development.

CHAPTER XVII

INORGANIC AND ORGANIC MATTER

I

ALL living things depend upon the carbon compound for their existence. The carbon atom has certain properties and qualities that make it particularly suitable for the expression of those activities peculiar to life. These we must discuss; but it may be as well first to glance at the general development of atoms.

Until recently the structure of the atom was asserted with confidence, but, while the orbital atom is still generally accepted, it is being modified in accordance with wave mechanics. Whatever may be the structure of atoms, they may all be derived from the simple hydrogen atom. This is stated to consist of one proton and one electron, the latter revolving round the proton ten million million million times a second, the diameter of its orbit being 100,000 times as large as the diameter of the proton, which means that the hydrogen atom consists chiefly of empty space. So are all atoms, in spite of the apparent solidity of rocks and metals.

Assuming that atoms are composed of mitrons, the latter must be inconceivably minute, but they build up the hydrogen atom and all others, from hydrogen with a weight of 1 to uranium with a weight of 238; the whole material universe is comprised of these atoms, and some regularity of development is necessary in atomic structure, which implies rational sequences.

It seems certain that there are ninety-two kinds of atoms, called the "elements." They are symbolized by letters—H for hydrogen, O for oxygen, C for carbon, U for uranium, and so on. Attached to these letters are numbers which indicate the weight and composition of the atoms; H with a weight of 1 is composed of one proton and one electron; O with a weight of 16 has eight neutrons, eight protons, and eight electrons; U with a weight of 238 has 146 neutrons, ninety-two protons, and ninety-two electrons. Neutrons as well as protons and electrons are found in almost all elements. The numbers are placed in different positions around the letters, each number having a special significance, the positions being agreed upon by scientific convention in order that they may not be confused with each other, yet at the same time indicating the structure and properties of the element. As this convention is not always observed, confusion is caused until one finds from the context or from inspection just what is meant. Generally speaking, the bottom left-hand number is the atomic weight; the top left-hand number is the atomic number—the number of electrons and number of protons in a stable atom. The difference between the atomic number and the atomic weight gives the number of neutrons in the element; thus ${}^{8}_{16}\mathrm{O}$ is oxygen.

The remarkable feature about atomic number is that all such numbers are whole numbers, there are no fractions, and this in spite of many of the atomic weights of the elements not being whole numbers. This will be referred to later, but, as atomic numbers indicate the number of electrons in the atom, the electrons are assumed to be indivisible, and as they seem to be wholly transformed into energy under certain conditions, no doubt this quality of indivisibility is one of their properties.

Atomic weight relates to the combined weight of all the protons and neutrons in the nucleus of the atom. The neutrons are without, or do not manifest, electricity. The protons and electrons have electric charges of opposite kinds, or signs, and as the charges balance one another they must be equal in amount. If the *atomic number* of an element is 6, this means that six electrons are travelling around the nucleus in one or more orbits. If the *atomic weight* of this atom is 12, there are twelve particles in the nucleus, six being protons which balance the six electrons electrically, the other six being neutrons which are electrically inert. These neutrons appear to consist each of one proton and one electron which have combined in some manner, and if so there are actually twelve protons and twelve electrons in the atom, six of each combining, retiring to the nucleus, and becoming neutral. Such an element is normal and stable, and is in electrical equilibrium.

When there are ninety-two electrons flying around in different orbits, with ninety-two protons and 146 neutrons in the nucleus, the complexities of the atom increase enormously. The atom itself seems to have succumbed to this complexity, because in the heavier elements the phenomenon of radio-activity indicates that the atom cannot stand the strain and breaks down.

Fig. 4 is a picture of the scientific atom. This shows growth of a kind—namely, hydrogen atoms joining together to form larger and more complex atoms. This growth or development is complicated by the intrusion of neutral substance, neutrons, into the nucleus of the more complex atoms, and even into the " heavy " hydrogen atom.

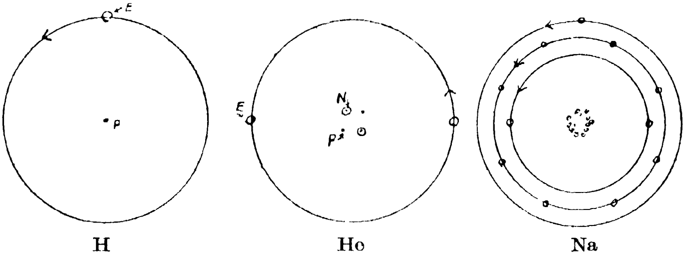


FIG. 4.—Atoms of hydrogen, H; Helium, He; Sodium, Na. The numbers of electrons, E, and protons, P, in these atoms are as follows :

		In orbit.	In nucleus.	In neutron.	Total.
H	1 E	1 E			1 E
	1 P		1 P		1 P
He	4 E	2 E		2 E	4 E
	4 P		2 P	2 P	4 P
Na	23 E	11 E		12 E	23 E
	23 P		11 P	12 P	23 P

All protons and neutrons are contained in the nucleus. In Sodium, therefore, there are 11 free protons and 12 neutrons in the nucleus.

Chemical analysis shows that atoms of the same kind—hydrogen atoms, for instance—join together to form molecules, a molecule being a compound consisting of more than one atom; these may be called atomic molecules. Atoms of different kinds—hydrogen and oxygen, for instance—also join together in certain well-established proportions to form compounds, these being chemical molecules. From these ninety-two atoms and their molecules all the material universe is constructed.

II

Affinity and valency are the means of harmonizing the ever-increasing combinations of atoms, and the structural arrangements of atoms to form molecules with different properties add not only to complexity but also to harmony in the constant adjustments of atoms and molecules to their internal and external environments. For it is highly probable that many molecules which were unfitted for survival were formed during the evolution of inorganic matter, and these were replaced by forms of different structure, or forms which developed from less stable forms, which could adjust themselves better to the circumstances of their existence. For instance, why is there no atom comprised of two protons and two electrons? The next atom in the scale above hydrogen is helium, which is composed of two protons, two electrons, and two neutrons. But there is no intermediate atom with two electrons and protons which may all act electrically. There are heavy hydrogen atoms of two kinds, one of which contains one neutron in its nucleus and the other containing two neutrons, but nevertheless only the electron and the proton can act electrically. It seems that the progress of the atoms from hydrogen upwards has been interrupted or frustrated in the endeavour to form a regular sequence of numbers of protons and electrons all functioning electrically, and certain protons and electrons have combined to form neutrons as a way out of the *impasse.* But all this implies an effort to attain a more harmonious condition rather than a blind rigid " law " acting with neither intelligence nor reason.

The more one considers atoms and molecules, the more it appears that Intelligence is operating in connection with them. If this be denied, then a series of laws or assumptions must be invented to account for the differing forms, phases, and properties of atoms and molecules. As an example, the number of electrons in the atom, called the atomic number, has a definite regularity. The hydrogen atom begins with atomic number 1, helium follows with 2, lithium with 3, beryllium with 4—and so on, increasing one by one until the ninety-second atom, uranium, is reached with atomic number 92. These numbers are the numbers of electrons in one or more orbits surrounding the nucleus of each atom. The inference is that all atoms are comprised of multiples of the hydrogen atom.

But the *weights* of the atoms do not seem to bear this out. They vary considerably, hydrogen having a weight of 1·00807, not 1, and uranium having a weight of 238·14, not 92. Yet there is a certain consistency about these atomic weights which is remarkable. Moreover, the properties and weights of atoms show regular relationships, and when all the atoms were arranged by Mendeléeff in a rectangular framework there appeared what he called a " Periodic Table " from which he deduced the " Periodic Law of the Elements."

(In this " Periodic Table " the numbers of horizontal Groups and vertical Periods given in books of chemistry and physics are not constant, but generally they are from one to eight in each case. It is an odd coincidence, perhaps, that the octahedral particle mentioned on p. 159 would have possible movements from one to eight.)

It has been discovered that the hydrogen atom may have one neutron or two neutrons in its nucleus as well as the one proton which balances the electron. This gives three forms of this atom, one with one proton in the nucleus, one with one proton and one neutron, and one with one proton and two neutrons, the weights being respectively 1, 2, and 3, though the atomic number is always 1. When an element has several atomic weights, the atomic number remaining constant, it is said to have as many isotopes as there are weights. Hydrogen has three isotopes, and the ones containing neutrons are called " heavy " hydrogen. About one atom in 6,000 has a weight of 2, and one in 100,000,000 has a weight of 3.

How do these isotopes come into existence? There may be " laws " in relation to them, but this will mean a separate law for each isotope if each differs in its properties. We are inclined to think they are the results of Intelligence trying out several ways of adjusting atoms to their environment, that isotope which is in the majority being the one best adjusted to its surroundings. The investigation of isotopes shows that they are always found associated together; an isotope of any element is never found apart from its other isotopes, which seems to indicate that they actually have been formed locally from the original element, and we assume that Intelligence has been instrumental in bringing about this formation.

The discovery of isotopes solved a difficulty in connection with atomic weights. If all elements are derived from hydrogen, why do so many of them have fractionate weights? They should all be whole numbers, but lithium has a weight of 6·9373, nitrogen 14·0071, sodium 22·997, sulphur 32·06, chlorine 35·457, uranium 238·14, and so on. When isotopes were discovered and the elements analysed quantitatively, it was found that a certain quantity of the atoms comprising any element had one weight, a certain quantity had another weight, another quantity had a third weight. Chlorine has three isotopes : the quantity of one of them is negligible, but of the remainder, seventy-five per cent. had a weight of 35 and twenty-five per cent. had a weight of 37. Now, (75 × 35) + (25 × 37) divided by 100 gives 35·5, which is about the weight of chlorine in the mass. From this it appears that atoms are built up from whole numbers both in weight and atomic number, and no doubt when all the elements are so analysed quantitatively it will be found that in each element, if the quantity of each isotope be multiplied by its weight and all are added together and then the percentage of the whole calculated, this will correspond to the weight of the element taken in the mass at random.

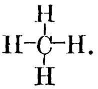
One curious isotope is that of " heavy oxygen " with a weight of 17. The normal weight of oxygen is 16. If nitrogen, weight 14, be bombarded with helium nuclei (weight 4) and a helium nucleus strikes the nucleus of a nitrogen atom, a proton (weight 1) is knocked *out* of it, but the helium nucleus remains *in* the nitrogen nucleus. This increases the weight of nitrogen by 3, its total weight then being $14 - 1 + 4 = 17$. But an atom with an atomic weight of 17 has the properties of oxygen and is therefore an isotope of oxygen, which means that nitrogen has been converted to oxygen by this proceeding. Actually, it is found that one oxygen atom out of 10,000 has a weight of 17. But it does not follow that they have all been produced in this manner.

The different isotopes of any element have the same valencies and affinities. This enables " heavy hydrogen " to combine with oxygen to form " heavy water," and this is now used industrially. But two atoms of " heavy hydrogen " combine with one of oxygen just as in normal water. How do the valencies and affinities adapt themselves to the various nuclear weights of isotopes? True, the difference in weight is slight in the case of the heavier elements, but the weights of " heavy hydrogen " are 100 per cent. and 200 per cent. heavier respectively than the simple hydrogen atom. Yet its valency and affinity seem to be unimpaired.

III

Affinity is the attraction of the atoms to each other or to other kinds of atoms; for instance, hydrogen has an affinity for oxygen, for chlorine, and for itself; carbon has an affinity for hydrogen, for chlorine, for oxygen; oxygen has an affinity for itself, for chlorine, and for many other elements. Valency is the extent to which atoms attract one another. Hydrogen has a valency of 1, oxygen of 2, carbon of 4. Other elements have these numbers also, and some have valencies of 6.

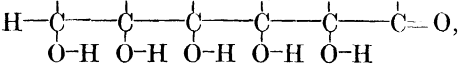
In any compound the valencies of the atoms concerning it must balance. Any element combining with one atom of hydrogen must have a valency of only 1. HCl is a compound of hydrogen and chlorine; therefore chlorine has a valency of 1. Carbon has a valency of 4, and therefore cannot combine with only one atom of hydrogen; if it forms a compound with hydrogen there must be four hydrogen atoms in the compound, which will have the symbol CH_4, attached thus :—



$$\begin{array}{c} H \\ | \\ H-C-H. \\ | \\ H \end{array}$$

Oxygen has a valency of 2, and in combining with hydrogen there must be two atoms of hydrogen to one of oxygen, H_2O, thus : $H-O-H$. It is as though each valence was a grappling-hook which can be attached to one other valence of another atom, and must be so attached where atoms have an affinity for one another. These grappling-hooks are seemingly peripheral connections between electrons, so the points of contact between atoms are very far away from the centres of the atoms.

In all compounds this principle of valency holds good. In the compound $C_6H_{12}O_6$, the connections are diagrammatically expressed thus :—



$$\begin{array}{cccccccccccc} & H & & H & & H & & H & & H & & H \\ & | & & | & & | & & | & & | & & | \\ H- & C & - & C & - & C & - & C & - & C & - & C=O, \\ & | & & | & & | & & | & & | & & \\ & O-H & & O-H & & O-H & & O-H & & O-H & & \end{array}$$

each dash representing a hook or valence, and an examination will show that the valency of each atom is satisfied, H having one, O having two, and C having four valencies.

Atoms with the same valency do not necessarily combine. An atom of either fluorine, bromine, iodine, or chlorine unites with hydrogen; therefore each has the same valency of 1. Chlorine unites with one atom of lithium, sodium, potassium, so these elements also must have a valency of 1; but they do not unite with hydrogen.

The degree of affinity of atoms has no obvious relation to valency. Affinity may be weak or strong according to the amount of energy necessary to combine them. In H_2O, one of the H atoms may be replaced by a sodium atom because sodium has a greater affinity for oxygen than hydrogen has. $H{-}O{-}H$ is water, H_2O; $H{-}O{-}Na$ is caustic soda, $NaHO$.

Many molecules with the same number and kind of atoms have different properties; these are called isomers. The molecule $C_4H_8O_2$ may be instanced as one which takes on different forms, different structure, and exhibits different properties. As $H{\cdot}CO_2C_3H_7$ it is propyl formate, as $CH_3{\cdot}CO_2C_2H_5$ it is ethyl acetate, as $C_2H_5{\cdot}CO_2{\cdot}CH_3$ it is methyl propionate, yet each has the same kind and quantity of atoms.

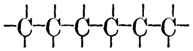
Great quantities and rapid changes of energy are essential for the many activities of animal life. Carbon compounds produce large quantities of energy with ease and rapidity, and this energy may be used immediately or stored up in certain forms and tissues. Life seems to be impossible without carbon; but this may be because on our planet carbon is the element most suitable for life to emerge and develop. It is quite possible that under other conditions silicon could take the place of carbon. The point is that Intelligence uses the best means for bringing about harmony in any particular set of circumstances.

Though it has four valencies, carbon can combine with itself in such a manner that two of its valencies seem to connect with each other within the atom itself while the other two are free to combine with other atoms. Carbon monoxide consists of one atom of carbon and one atom of oxygen, CO. The carbon has four valencies, oxygen has two; two of the carbon valencies join up to the oxygen atom thus: $<C{=}O$, the other two joining together. If more oxygen is available, the two internal valencies of the carbon atom combine with another atom of oxygen, the compound becoming carbon dioxide, CO_2, or $O{=}C{=}O$, wherein all the valencies are satisfied. Or if the CO molecule comes into contact with chlorine, which has one valency, the two

internal valencies of the carbon atom combine with two chlorine atoms to form $COCl_2$, thus: $\begin{matrix}Cl\\Cl\end{matrix}\!>\!C{=}O$. This is phosgene.

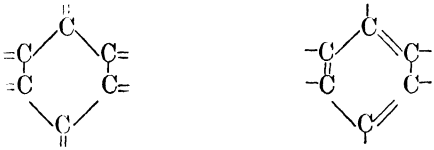
These examples show how easily carbon will unite with other elements as well as with itself, and therefore is able to form those huge and pliable molecules which eventually exhibit the phenomena of life. We have no knowledge why the carbon atom should have the power of linking up into large groups of molecules. It seems to be due partly to its high valency, but other atoms have four valencies, some have five, some have six; yet none of these form such groups as those of carbon.

The manner in which carbon atoms link together is another reason why this atom can form so many compounds. The atoms can link in chains thus:—



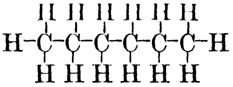
$$\begin{array}{ccccccccccccc} & | & & | & & | & & | & & | & & | & \\ - & C & - & C & - & C & - & C & - & C & - & C & - \\ & | & & | & & | & & | & & | & & | & \end{array}$$

or as rings, (1).



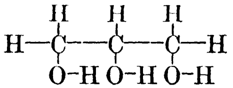
(1)

This is only the framework of carbon compounds, the whole molecule not being complete until other atoms are attached to its free ends, (2) and (3).



$$\begin{array}{ccccccccccccccc} & & H & & H & & H & & H & & H & & H & & \\ & & | & & | & & | & & | & & | & & | & & \\ H & - & C & - & C & - & C & - & C & - & C & - & C & - & H \\ & & | & & | & & | & & | & & | & & | & & \\ & & H & & H & & H & & H & & H & & H & & \end{array}$$

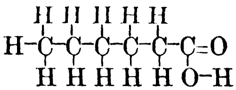
(2)



$$\begin{array}{ccccccccc} & & H & & H & & H & & \\ & & | & & | & & | & & \\ H & — & C & — & C & — & C & — & H \\ & & | & & | & & | & & \\ & & O\text{-}H & & O\text{-}H & & O\text{-}H & & \end{array}$$

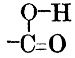
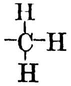
(3)

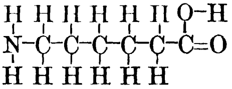
Other atoms may take the place of hydrogen, (4), with the result that thousands of different compounds are formed with this six-carbon-atom basis.



$$\begin{array}{ccccccccccccccc} & & H & & H & & H & & H & & H & & & & \\ & & | & & | & & | & & | & & | & & & & \\ H & - & C & - & C & - & C & - & C & - & C & - & C & = & O \\ & & | & & | & & | & & | & & | & & | & & \\ & & H & & H & & H & & H & & H & & O\text{-}H & & \end{array}$$

(4)

Again, groups of atoms may take the place of hydrogen, or, rather, connect with one of the carbon valencies instead of hydrogen. See, for instance, (5), where the group H-N-H takes the place of an end hydrogen atom, and the group  $\begin{array}{c} O\text{-}H \\ | \\ \text{-}C{=}O \end{array}$ takes the place of the end group  $\begin{array}{c} H \\ | \\ \text{-}C\text{-}H \\ | \\ H \end{array}$ in (2).



$$\begin{array}{ccccccc} H & H & H & H & H & H & O\text{-}H \\ | & | & | & | & | & | & | \\ N & \text{-}C & \text{-}C & \text{-}C & \text{-}C & \text{-}C & \text{-}C{=}O \\ | & | & | & | & | & | & \\ H & H & H & H & H & H & \end{array}$$

(5)

It will be seen that all valencies are satisfied in these diagrams, C having four, N having three, O having two, and H having one, and from these some idea may be formed of the importance of the carbon atom in building up of many different kinds of molecules. The diagrams show changes in the ends of the molecules, but such changes can take place in connection with any of the hydrogen atoms in the molecule, which enables it to branch out into numberless forms, and some giant molecules may consist of thousands of atoms.

The formation of carbon atoms into chains and rings of six or multiples of six is one of the most striking features of this element. In connection with these carbon compounds certain important phenomena must be noticed. First, there is the very large number of atoms in some molecules—sometimes well over 2,000. Then, there are molecules with different properties but with the same number and kind of atoms, forming the isomers previously mentioned. Again, there is the importance of the *position* of the atoms in the molecule, each different position being accompanied by different properties. The greater the number of atoms in the molecule the greater changes in position there may be, and the greater the number of different properties. C_2H_6O forms two compounds with different properties; $C_8H_{12}O_4$ forms over sixty compounds, thus having over sixty different properties. How many compounds, then, can be formed from such a molecule as the organic chlorophyll molecule, which has nearly 2,000 atoms?

While the carbon compound can grow to comparatively enormous dimensions, it is very unstable compared with inorganic compounds. It may be its very size and complexity that result in this instability; yet it is this same instability, with the consequent rapid changes of energy, that eventually produces the remarkable phenomena of life, and which enables the many forms of it to develop and survive. So the formation of these large carbon compounds is one of the most important stages in the development of life, and we must therefore endeavour to understand the changes that take place between inorganic and organic matter.

IV

We have seen that in the molecule with a six-carbon-atom basis the carbon atoms link up to hydrogen, oxygen, and nitrogen, and that the end atoms of the $6CH_2 + H_2$ molecule may be replaced by a nitrogen group at one end and an oxygen group at the other. Each of these end groups acts as one unit, as a sort of complex atom acting and combining as a group instead of by its separate atoms. Now, chemically, the nitrogen group is a " base " and the oxygen group is an " acid." Acids and bases have an affinity for one another and will combine and neutralize each other when they are in a position to do so, somewhat as the electron and proton neutralize each other electrically. When they are at opposite ends of a carbon compound this is impossible, but if two such compounds come together the ends will seek out and join each other—the oxygen end to the nitrogen end—by chemical action, and a double molecule will be formed. But it will be noticed that there is still one free end with a nitrogen group and the other free end with an oxygen group, and these again will unite with other molecules similar to themselves, and so a huge carbon compound will grow by these unions until physical conditions prevent its further increase. Such groups may also take the place of other hydrogen atoms in the carbon compound—the foregoing deals only with the *end* hydrogen atoms—and the result is a complex molecule with perhaps sixty or more original molecules in its composition, all held somewhat loosely together and easily broken down by other chemicals—ferments and enzymes, for instance.

This union of whole molecules is called " molecular affinity," and the extent to which they unite is called " molecular valency." Many molecules will not unite at all and they have no molecular affinity. Very few molecules have this property which is such a prominent feature of the carbon compound, and it is because of this molecular affinity that carbon forms the basis of life. Molecular affinity also occurs in inorganic compounds, but to a much less extent than in the carbon compounds.

The inorganic molecular affinities and valencies, and inorganic colloid forms, show how gradual is the change from an inorganic state through the carbon compounds to an organic state, and at no place can it be said that interference from some external power is necessary to endow matter with life. Intelligence has ampler opportunities of expression in unstable compounds, and can therefore act more readily, more quickly, which enables the compounds to respond more freely to external conditions by adapting themselves to their environment. But the process is not due to the molecule trying unreasonably to change its constitution, to achieve new forms, to build up a more complex atomic arrangement with a specified end in view; it is only trying to resist dissolution by adapting itself to, and harmonizing itself with, an ever-changing environment.

This carbon compound is not produced by chance and then utilized to build up protoplasm. It is produced gradually and intelligently in many attempts to find means whereby the contingencies of the environment may be met and overcome. It must not be thought of as a diagrammatic grouping of atoms calmly and methodically obeying physical and chemical laws, but as millions of tiny groups in energetic activity, densely packed together, losing equilibrium by contacts with their environment, and restoring it by chemical and electrical attraction with atoms and molecules that afford a temporary balance with their specific group structure; masses of molecules in rapid vibration, twisting and striving, joining and breaking away, thrusting out loose unbalanced ends which endeavour to join up to each other or to draw to themselves stray particles or molecules, seeking to utilize them for the maintenance of their structure, the amino or basic end of one molecule joining the carboxyl or acid end of another and the two forming a larger molecule which is unbalanced for the moment until the basic and acid ends of the huge molecule produced by several such linkages eventually join together, when equilibrium is reached.

Electrical and chemical action are very important in these actions and reactions, and in the still waters of shallow ponds, and in lagoons left by the oceans as the earth rises from the sea, these new compounds can live and flourish. Ultra-violet light, a congenial temperature, dissolved food substances, all combine to encourage the growth of organic compounds. Constant changes occur incessantly, but are stilled a little in the darkness of the night, and thus a rhythm due to light and darkness arises in the molecules of life, a rhythm that beats for a thousand million years through all evolving things, even to our own hearts and brains, nerves and emotions.

The conditions of these new environments and these new forms with their loose attachments allow the valencies of the atoms and molecules to operate much more freely than in the more stable compounds. Sulphur and nitrogen atoms drive away some of the hydrogen atoms and take their places, giving new shapes, new properties, new powers to the rearranged molecules, which in their turn grow and combine and change in countless millions of forms. Atoms have from one to eight valencies; the colloid molecules have sixty or more valencies. Imagine a piano with eight notes—not many tunes can be played on it. Imagine a piano with sixty notes—the number of tunes that can be played on it are beyond mathematics to compute. This will give some idea of the possibilities of this remarkable carbon compound, and already over one million compounds of CHO alone are known. Generally speaking, they have a gelatinous consistency and for this reason are called "colloids" (from the Greek, *kolla* = glue).

V

Out of these attractions, repulsions, equilibria, harmonies, there arises a form loosely organized which sends out molecular tentacles to draw in the less highly organized molecules, which it breaks up and incorporates within itself, using them to repair its own damage and waste, and then, finding this an easy and satisfactory procedure, it uses them to increase its bulk until its size is limited by its physical inability to grow larger. Then it divides or pieces break away, and these pieces repeat the whole process, moving away from the mother group in search of more food, and so individuality begins.

This hungry, creeping, unbalanced, growing molecule is something new in the universe. It has powers never before exhibited, and soon it grows to such a size and in such a way that the central part no longer contacts with the outer environment. Its outer molecules, after satisfying themselves, allow the surplus remnant to be chemically drawn towards the molecules within the group, the result being that these inner molecules exist without the urge and strain of seeking the means of subsistence—they become, in a sense, parasitic on the external molecules, those in direct contact with the environment—yet they support the outer molecules, giving them a form which is stable and which presents the greatest surface to the surrounding medium. The break-up of the food substances supplied to them releases energy they do not require, and this is utilized by the outer molecules to give them greater physical activity by means of which still more food is obtained. There is a differentiation of activities stabilizing the group of outer and inner molecules, which is no longer broken down as was the case when it was a free giant molecule; the loose ends have all joined together and a continuous permanent existence is maintained with a protected inner group of molecules and an outer active boundary which attracts other atoms and molecules, breaking down the latter and passing them to the inner group with liberation of energy.

This greater stability is followed by the fixing of the molecules in positions relative to each other, forming a structure wherein all have definite relationships to the whole group. When this huge differentiated molecule grows too large to maintain its form, it becomes reduced not by throwing off outer molecules, because they are all attached to the group in an organized manner, but by both outer and inner molecular groups dividing into two equal parts, each having a structure similar to each other and arranged like the original group but smaller. The obvious way of making this division is by the group stretching elliptically and then becoming constricted in the middle until the outer molecules come into contact and cut off the two parts of the ellipse to form two new, smaller, groups.

It would take millions of years for this organized group to develop from the giant colloidal molecule; but time is of little consequence to the origin and development of suns and planets and life, and this result is only one out of innumerable efforts on the part of inorganic and organic matter to build and change and break up in the endeavour to maintain harmony in a changing and ever more complex environment. Those which succumbed in the struggle left no fossils to blaze the trail of martyrdom, but were absorbed by other more successfully organized groups, or were set free as atoms to begin a new attempt or to join up with their fellow-atoms in an inglorious gaseous monotony.

In these new groups the inner part leads a sheltered existence, and as the struggle with the environment has been delegated to the outer molecules, it is able to organize its structure for the better production of energy in order to protect the whole from disintegration, to save it from the depredations of hungry enemies, to receive and absorb those atoms and molecules which now may be called food, to elaborate its structure with greater economy of material and effort, to adjust its method of dividing with greater exactitude. In such a manner the development of the giant colloid molecule results in an organized association of molecules dependent on each other, with differentiation and division of labour. It moves, it assimilates, it grows, it divides. In point of fact, it shows all the phenomena of the primitive living organism, and is the first formed naked protoplasm.

VI

Before life can express itself, certain changes are necessary between inorganic and organic matter. Inorganic colloids are found very early in the formation of the earth. They appear in primeval waters, and colloidal forms of alumina and silica are present in sedimentary rocks. Long before living matter appeared it is probable that some form of inorganic colloid, or the element selenium, or some other substance, transformed the energy of sunlight into chemical energy, which acting on or within the colloid, produced a simple organic colloid possessing a greater store of energy. These two colloids, organic and inorganic, would remain associated together, but would be less stable than the inorganic colloid owing to their more complex structure. Eventually, complexes of inorganic and organic matter would come into existence as crystallo-colloids, and these would lead to life-forming substances.

That such a process is not impossible is shown by the production of artificial formaldehyde. This organic substance is stated to have been formed by passing carbon dioxide through a salt of uranium in the presence of sunlight. Now, formaldehyde is the first product of photo-synthesis in the green leaf, and from this is formed starch, the first *visible* product of photo-synthesis, after which the sugars are produced. These are essentially products of living matter. If the formaldehyde produced artificially can be converted into starch and thence into sugars, the two processes, inorganic and organic, will give the same results from entirely different origins, and it will be apparent that life may in some such way be developed from a non-living source. Moreover, certain inorganic crystalloids are the inevitable accompaniment of proteins—without them the proteins cannot function properly—and this necessary association is again an indication that life has developed from non-living matter. Otherwise why should inorganic matter be necessary for the functioning of proteins?

Here we are getting near to the origin of life. Of course, life never had an origin in the sense of a definite beginning at a certain stage of evolution. It is the gradual emphasis of a particular method of molecular change which develops out of the endeavour of certain molecules to retain their structure and form in an environment which is gradually changing. We cannot anywhere say: "Here is a molecule without life and here is an exactly similar molecule with life." This would imply some sort of external interference, life coming out of the void and attaching itself to certain molecules of peculiar structure. This would also mean that the molecules would have to develop from a structure, A, which could not under any circumstances be endowed with life, into another structure, B, which would be prepared to receive life when life happened to be in the vicinity. In such an event life must have existed in a state ready to enter the molecule at a suitable moment—namely, just when the molecule was ready to receive it. But this also necessitates another kind of living condition and only removes life to another previous phase of existence, even though that phase is immanent in the environment which surrounded the life-receptive molecule. We should also have to assume that this primitive life state is still all about us in our environment quite apart from actual living forms. Such a notion is without warrant, and no one asserts this sort of unnatural condition of life.

We have, then, a molecule composed of such elements and in such a form that it grows by absorbing more elements or compounds similar to those of which it is composed, and places them in definite positions so that they form one or more molecules similar to the original one. This group, now consisting of two or more molecules, can split up into smaller groups of one or more molecules which begin the operation again, and this goes on indefinitely. This process is the life process, consisting of absorption, growth, reproduction. Life is the term used to express the combined actions and operations of these extremely complex carbon compounds, and they are all the result of the Intelligence of the universe seeking to bring about harmony between the different forms of matter and the environment which has resulted from their development.

Inasmuch as life has emerged in this manner we must dismiss the idea that a lifeless chemical compound can be endowed with life and then, after using it for certain definite purposes, pass this life on to other similar compounds. For even if such a thing could happen, we should have to ask how the lifeless compound would know what to do with the life it received? What sort of change would life make to the compound? What new attributes would the compound have when it became alive? How would life animate lifeless matter if no additional substance and no structural change occurred? How could a compound with exactly the same naturally developed structure, form, and properties, be in both the living and non-living states while at the same time being in contact? How would the lifeless compound know what it was expected to do? How would it proceed at once to perform all the intricate behaviour of a living organized body? How would it act so as to take its part in the organic nature of that which had given it life?

VII

Can we call upon something in the nature of law, " Natural Law "—that term which covers a world of ignorance—to force the compound to become alive, or to become infected with life, or to compel something already living somewhere to give some of its life to a similar but lifeless compound, or to touch it with a kind of magic wand whereby it receives the " breath " of life? Where can there be such a " law," and in what? Or is there some external catalyst, some ethereal enzyme, at work here? But this would only remove the origin of life to another sort of external source, and the problem would still remain, but intensified.

The alternative is that life is already existing in the compound which has been formed in the processes of inorganic and organic development, and is not something novel, but is the term used to indicate certain manifestations which are natural to the extreme complexities of these huge colloidal carbon molecules, and which have arisen step by step in a perfectly natural manner. Because we cannot as yet trace all the details of these steps, this is no reason for introducing external interferences for which there is no evidence and no warrant, and which mystify everything without explaining anything.

With this power of building up carbon compounds little by little into vast aggregates by the method of attaching molecules to themselves instead of having to build themselves up anew from the atom, a new sort of organism and of environment came into being. A new world of chemical action and organization dawned on the earth. This new phase of existence had at its command illimitable quantities of material, and the constant breaking down of huge molecules and building them up again proceeded with ever-increasing intensity for millions of years.

To a human being there would appear to be no advance from century to century, from millennium to millennium, but the changes constituted such an enormous advance in chemical formation and adaptation to the new environment created by its own activities that eventually, during these millions of years, a form arose with properties beyond anything that had gone before. This form moved by its own initiative; it absorbed chemical compounds from without, compounds of different constitution from itself, and re-formed them into a substance which it could utilize and convert into a substance like itself and which became incorporated into its own organization as part of itself; it also retained its continuity by becoming larger, until at a certain point it divided into two similar parts which repeated the whole process. This chemical form appears to show all the phenomena of life.

From this stage progress towards more complex organic structure proceeds quickly. The environment changes and becomes partly organic by the breakdown of organic molecules which still retain their partially destroyed organic form. This means greater competition, because such easily obtained food results in a great increase in the number of new organisms. The struggle for existence begins actively with the rise of these organisms, some being better able to survive owing to their greater powers of obtaining food and of resisting antagonistic forces in the environment; much more rapid changes of structure and of organization follow, and the struggle for survival becomes keener with the more complex conditions of life. As the less organized forms cannot maintain the struggle they die out, while others change and their progeny survive. Distinct varieties arise through the particular methods of association, of better adaptation to circumstances, of more efficient ways of acquiring and absorbing food, the gulf between non-living and living compounds widening, while the organized chemical glides smoothly into the ways of living matter as we know it and man looms out of the distant shadows.

VIII

Almost all living things depend primarily on a few comparatively simple factors. First, the presence in the atmosphere of carbon in the form of carbon dioxide, CO_2. Second, the power of this gas to enter into combination with other compounds containing hydrogen, oxygen, nitrogen, which form the basis of life chemically. Third, the energy in the form of sunlight which enables these combinations to take place. Fourth, the means of applying this energy to carbon dioxide and other compounds which form the basic compounds of life.

The energy of sunlight is transformed by chlorophyll (*khloros*, green; *phullon*, leaf), or "leaf-green," into the chemical energy necessary for these combinations. Chlorophyll is found in plant cells which may be likened to a workshop where energy in the form of sunlight drives the mechanism—chlorophyll—into which several substances are placed—carbon dioxide (CO_2), water (H_2O), ammonia (NH_3)—and out of which appear the first compounds of life in the form of hydrocarbons, carbohydrates, and proteins, these being the invariable accompaniments of living matter.

Certain very primitive forms of life exist which do not need this process, and these may be the precursors of the commoner forms of life. These are highly important, because they bridge the gap that seems to exist between organic and inorganic matter; they will be referred to later.

In the changes taking place in the formation of organic compounds from simpler ones, large quantities of energy are absorbed, and it is this energy which enables life to be carried on. There must be a constant balance between building up and breaking down if life is to be maintained. In the plant there is an excess of building up—anabolism—and in the animal an excess of breaking down—katabolism—therefore the animal depends entirely on the plant, directly or indirectly, for its existence. Much of the energy of the plant is used up in its own life-processes, because plants need energy to enable them to carry on, just as animals do. But the excess balance of energy is so great that not only does all animal life depend on it but in the past it has formed huge stores of latent energy in coal and peat which man is now using for his own purposes.

The plant did not set out to perform this useful service to the animal; it is for its own uses that it converts the simpler compounds into the more complex ones, and the excess enables it to grow. The animal consumes the plant before the latter appropriates its excess energy for its own uses. Soon after the dawn of life certain cells found it easier to absorb this plant-energy than to manufacture their own compounds, and in doing so they became the forerunners of all animal life, from protozoa to man, all virtually parasites on plant life.

IX

Let us digress for a page or so. It has been mentioned that life has probably evolved on earth from non-living matter. Other possibilities are: (1) that life has been conveyed to the earth by meteorites; (2) that life can pass through interstellar space from one orb to another, small organisms somewhat similar to spores having been stated to be able to float through the ether, and as some spores can withstand a temperature of – 200° C. it is assumed they can withstand the cold of the " ether " and may thus be distributed all over the universe; (3) that life was introduced into matter by some exterior supernal power.

The first of these is untenable. Meteorites will not support any sort of life; they become white hot in passing through the atmosphere, and this would completely incinerate all living organisms. The second is a very doubtful supposition, and even if it could be demonstrated it only removes the origin of life farther back, because such living spores must have originated somewhere, and so must have evolved from non-living matter in another place, or have had an origin exterior to matter. The third possibility is the one generally accepted by those who have paid little or no attention to scientific interpretations of the facts of life and its development. It means that to some primitive organic form, some colloid, or some amino-acid compound, life must have been given by some power exterior to all matter existing up to that time. We need not dwell upon this, because it is a gratuitous assumption without any evidence whatever, and even if it were true it would only mean that organic evolution of higher forms of life began at a particular point in chemical evolution, and that microbe and man have developed from that first life-endowed chemical. Such an assumption would also create many physical and chemical difficulties, such as the condition of the compound before and after receiving life, of what precisely the change consisted, how it manifested itself differently from its pre-living condition, whether its behaviour was controlled by the outside power after its conversion, or whether it continued to behave as before with some added properties which were controlled by itself—though how it would know how to exercise such control is impossible to imagine, because it would have had no experience to guide it. Moreover, such an interference followed by organic evolution would completely confirm the evolutionary theory which would rather stagger those who called in exterior aid to account for the origin of life in a complex chemical compound.

We must therefore reject these three possible methods of accounting for the first appearance of life on our earth. No facts have ever been discovered to support them. All the facts and probabilities go to show that life has evolved from what appears to be a non-living state and that man himself has gradually developed from a primeval protoplasmic substance. This substance was derived from inorganic matter, a union of the elements C, H, O, N, S, and some others taking place, in some manner at present unknown, to produce what we call a living organism.

Life is invariably connected with the growth and change of the substance with which it is associated, and though it seems to be a part of the chemical compound, it does not become manifest until the " compound of organic life " reaches a certain phase or state, that state being what is called protoplasm. Its particular properties are growth by absorption and the power of prolonging its existence perpetually by dividing and growing again. Eventually the cell is produced, the formation of which appears to be something entirely unlike any previous chemical phenomenon; its structure is chemical, but it carries within it the changes which have taken place in the organism that preceded it, yet of which it was a part. These changes are associated with life; without life they do not occur.

X

It has been assumed here that Intelligence is in the primitive particles and finds its first expression in exercising free-will in the mitron. The urge for increasing expression seems to be obtainable only by an increasing complexity, and through this complexity new methods of expression are developed. Had Intelligence been merely an urge for maintaining a material existence it would have been satisfied with the molecule, or even the mitron. Under the stresses and strains of its environment it would have endeavoured only to regain or to maintain its simple forms.

Now, all the phenomena associated with the mitronic world—movement, electricity, magnetism, gravity, memory—are found in the living organism, and possibly organic life is nothing but these in a peculiar form which is almost, if not quite, centred in the carbon compound. But something new has developed. A chemical compound *without* life does not react to a stimulus as does the same compound *with* life. Take the life away and the compound is altered in some unknown manner. There is no life without the rapid absorption of atoms, of the building up and breaking down of complex molecules. Thus the living organism needs an ever-constant renewal of its constituent molecules by absorption, and as there is Intelligence in all these atoms, there is an accumulation and a greater expression of it as the forms of life grow more complex.

Did organic life emerge under certain conditions as a chemical necessity? The common but unexplained marvel of new expressions and experiences arising out of combinations of simpler ones—for instance, water arising from a combination of hydrogen and oxygen—may be called emergent. But emergence in living matter is a quite different thing. Form, differentiation, structure, organization, emerge and emerge again with every generation. And it changes as it emerges, because one generation is never exactly like the one which preceded it. Life is a vastly more complex expression of Intelligence than anything that has gone before, for Intelligence leaps forward with the absorbing colloid.

Life seems to be dependent on carbonaceous and nitrogenous compounds, but this may be because these compounds are the best media in which Intelligence can express itself under the particular conditions of this planet. In a different atmosphere, a different environment, some other basis would perhaps serve equally well. Life cannot be prevented from developing, though the degree to which it develops depends on the environment—that is, on that part of Intelligence which the *totality* of Intelligence itself has produced in its development. But inasmuch as life has emerged on this earth, it will again emerge in some form in different parts of the universe under suitable conditions, because it is not the result of outside interference, but is inherent in primeval substance.

Life as we know it need not occur on other planets, but something akin to it will no doubt develop. It may be of a different quality, higher or lower, but, whatever its nature, it will be just as much the expression of universal Intelligence as our earthly life. Any life there may be at present in the sun cannot express itself or understand the universe as life on earth can; yet in all probability some sort of life with an Intelligence similar to ours will develop there eventually when the sun grows cold enough for the development of the atomic or colloidal aggregations in such forms as will enable Intelligence to express itself as it does on earth, or in other ways which to us would perhaps be unintelligible. A somewhat wild conjecture, but we ourselves see clearly that Intelligence is not confined to this earth or to earthly limitations of expression. As there could, however, be no bright light or great external heat such as obtains on earth, because other suns are too far away from it and they also would have grown colder, the appearance of sun organisms would be very different from ourselves, but Intelligence would produce some organism which would be equivalent in intelligent expression to that we possess and which would reach stages perhaps much higher than those we may eventually reach on earth.

It does not matter in the least what form life takes. From microbe to man, life is the principle that builds up the organism, carries it on, and breaks it down. The nature of life, its apparent purposiveness, its intelligence, its special phenomena of growth and heredity, seem to indicate a new influence associated with previous "natural" forces. In this event, such influence must be either inherent in these forces or must be outside them. But there is no outside, and life is inside the universe of matter. So far, life is the ultimate achievement of Intelligence, and no outside aid need be called upon to account for the differences in constitution and properties between the colloidal molecule on the one hand and the compound of organic "life" on the other. In each case they are only complex forms of similar basic materials. Thus there seems to be no room, no opportunity, no necessity, for any external interference in natural phenomena.

CHAPTER XVIII

LIFE

I

WHAT is organic life? It is the expression of behaviour in an organized group of colloid molecules, this expression taking the form of (1) growth by the absorption of energy-containing substances and their conversion into the substance of itself with release of energy, and (2) separation into two or more individuals by the division of one organic group into other similar but not necessarily identical groups.

These are the essential factors of life as distinguished from the factors of any other chemical action. There are many phenomena accompanying these factors which seem to be necessary, but primitive life—that from which all living forms have been derived—exists with no other specialized attribute beyond these two. And it may almost be said that the second factor is really the only essential one, because the first may be already found in the most complex colloids. Movement, living groups of cells, organized bodies, senses, feelings, thoughts, and many other expressions of life and intelligence are all later additions, but every organism, whether amœba or man, must at one phase of existence consist of a complex group of colloids the principal distinctive characters of which are the (1) and (2) mentioned above.

The complex colloid builds up its internal structure by the absorption of such atoms and molecules as it requires. The transition from this colloid to the living organism is the most important epoch in the world's history, yet, if the organic colloids were built up in the manner suggested, the living and non-living colloids would be so similar that the enormous importance of the change would not be suspected by an observer who was not acquainted with the subsequent development of the living colloid. But it must be understood that this gradual development of the living molecule is not yet known. Proteins, the huge nitrogenous carbon compounds, are unknown in nature apart from the living cell; so are the carbohydrates and some complex hydrocarbons. Conversely, the living cell does not exist in the absence of the protein molecule. Nevertheless, very complex inorganic colloids do actually exist in nature apart from carbon.

Many organic compounds have been produced in the laboratory, the first of these being urea, $CO(NH_2)_2$, but laboratory conditions are not found in nature and no organic compound produced in the living organism has ever been discovered to exist naturally apart from life. Nevertheless, if such compounds can be produced from non-living chemicals, it is evidence of the possibility of the simpler hydrocarbons and carbohydrates being developed from such chemicals if the conditions existing in the primitive stages of the earth's development permitted of it. It may be pointed out again that, while life is not known apart from the proteins, neither is it known apart from inorganic substances. The inorganic residues obtained from the analysis of the proteins have proved to be quite essential to their existence; without these, neither protein nor life is possible, which again indicates how close are the links between organic and inorganic matter, especially when one considers the fact that inorganic matter can exist without life, but life cannot exist without inorganic matter.

The development of the proteins from colloids and the transition from the protein to the first-formed living organism can only be conjectured, but research on the living proteins by means of X-rays is approaching the stage where the construction of living matter is shown to differ very little from that of the non-living proteins.

This is an extremely interesting stage in the development of life from non-living matter, because if ever interference from an external source has taken place in the long lineage between the origin of the atom and the origin of life, this is the most probable place for such interference. What is the difference between a colloidal group without life and a similar colloidal group with life? The non-living group builds itself up from carbon, oxygen, hydrogen, nitrogen, as we have seen. It is an unstable body easily broken down, absorbing and giving out energy during the stages of building up and breaking down. The primitive living body is almost exactly the same thing; how can the differences be accounted for?

If the transition between non-living and living colloids can be explained by scientific research, then life as we know it is not the expression of an already existing external-eternal life, but a gradual development from a static to a dynamic condition of a highly complex colloidal molecule. This colloid is a more or less organized mass which grows, divides, and grows again, but it is free to break up altogether either because of some physical disharmony, some unequal distribution of its atoms, some incompatibility in the environment, and its life ends.

Let us say again that every individual Intelligence—mitron, atom, colloid, plant, animal, man—is immersed in a sea of other individual Intelligences, and each attempts to achieve its own harmony by adapting itself to those others, joining with them, escaping from them, controlling them, or, if possible, ignoring them. Thus, the effort of every existing thing, from mitron to man, is to maintain its stability, to remain in existence, in the face of an environment which in its turn is also endeavouring to maintain its own existence. But the protein molecule is a single group of insecure molecules, and the environment consists of similar groups of molecules attempting to detach its outer defences, of dangerous disruptive chemicals, of strange unfriendly atoms, of electrical discomforts, of disquieting changes of temperature, of disturbances in the chemical and physical balance of the surrounding medium. So, although it has arrived at a high state of organization, it has little tenacity, little resistance to environmental destructive forces, and is hard-pressed to maintain its structure, its form, and its internal and external molecular relationships. It cannot stagnate—if it did it would lose its activity and could make no further changes; it would begin to disintegrate into the lesser harmonies.

Without Intelligence the colloid group could never have reached this stage, and its group organization is the result of the combined Intelligences of all the atoms and molecules comprising it. As organization becomes more complex we shall find it more and more difficult to realize that all existing things are but the expression of that Intelligence which is at once the maker and the master of the universe. Remember always that the substance of the universe is Intelligence in action. Hence the Intelligence of the organized group of colloids builds up a resistance to disintegration, though the individual colloids are broken down almost, but not quite, as fast as they are built up. In that " not quite " lies the survival of a sufficient number of colloids to maintain the type, and these are adapted to the exigencies of the environment in which they exist. Thousands of types will have disappeared in this struggle for survival, and only that type which is in the line of organic development eventually rose above the level of the rest of the colloidal groups. Although the term " struggle " is used, it is not an active contest between one group and another, but only a building up by internal co-operation and a breaking down due to some inequilibrium or disharmony between the group and its environment or in the constitution of the group itself—an entirely passive occurrence, and only because it is in greater harmony with its environment taken as a whole does the group succeed in maintaining its position at the spear-point of progress.

II

In the endeavour of the Intelligence of the advanced colloidal group to maintain its existence, remarkable changes take place—the most remarkable in the history of the universe; quite possibly the most remarkable that will ever take place until the world's end. Further investigations into colloidal chemistry are throwing more light on to this epoch of evolution, which is in some ways the most important of all stages of development, and it is probable that " life " originated in some manner generally similar to that indicated in the following notes. But if it should prove to have originated in some entirely different but as yet unknown manner, this may still serve to confirm that principle of Intelligence which seems to be, and which we believe to be, at once the past, present, and future controller of all development.

First, let us examine some of the primitive conditions of the earth previous to the appearance of the proteins (see also page 28). There was, of course, no life on land or in the seas. Any dry land appearing above the seas consisted of naked rock, bleak and barren. The earth was hot and the sun brighter than it is now. Ultra-violet rays came directly into contact with the surface of land and water, and under its influence chemical action took place between hydrogen, nitrogen, oxygen, and carbon. The seas were warm, there was a large amount of hydrogen in the atmosphere together with methane (marsh gas) CH_4; water vapour, H_2O; carbon dioxide, CO_2; with little or no free oxygen. Ammonia, NH_3, was formed in the hot steaming atmosphere by the action of water which condensed on the land and combined with the nitrides contained in the earth or by electricity combining the N and H in the atmosphere. From CH_4, NH_3, and H_2O, the first salt, ammonium carbonate, $(NH_4)_2CO_3$, is formed. The primitive seas and oceans were not salty as at present, because the salt of present seas is "common salt"—sodium chloride, NaCl—which is a land product, and in those days there was not enough land above water, or torrents and rivers to wash it out of the land into the sea, to produce any appreciable amount of this. It will be noted that these compounds—CH_4, NH_3, H_2O—provide the principal ingredients of proteins—that is, of the essential nitrogenous compounds of life.

In confined shallows—ponds and lagoons—there would be a concentration of these nitrogenous compounds when they were formed, because the chemically active ultra-violet rays of the sun were not stopped by ozone or oxygen in the atmosphere, and these compounds would be formed on the surfaces of sand and built up by the action of these ultra-violet rays on CO_2, NH_3, and H_2O. These rays also produce carbohydrates, the sugars, from CH_4 and H_2O, with the escape of free hydrogen. The reason why these processes occur in the shallows is because the compounds are much more concentrated there than they could possibly be in the deep seas, though they occur in the seas extensively without producing complex forms. Hence it is unlikely that life originated in the oceans. Silica assists in the formation of nitrogenous compounds because it is a good catalyst; that is why they are formed on the surface of the sand. And so, although there was as yet no life, many of these compounds occurred in the shallow lakes and ponds.

During millions of years great concentrations of these nitrogenous compounds would take place, and they would assume a colloidal condition as they grew into great groups such as are found in organic matter. Their constitution would be very like those of the proteins, and so we find in these primitive seas such natural conditions of substance and environment as enable us to visualize how the first nitrogenous compounds were built up, and these lead straight to the proteins which form the basis of living matter. It has been suggested also that as neutrons may be produced by cosmic rays, or by X-rays from radio-active substances in the sea, these neutrons would in some manner "bombard" the nuclei of chemicals dissolved in the sea-water. The neutrons from a radio-active carbon atom would transform a normal carbon atom into nitrogen by the carbon atom absorbing a neutron, and then an electron would be attracted to the unstable nucleus, the result being the formation of nitrogen : $C + n = C^x$; $C^x + e = N$. The nitrogen would form a carbon–nitrogen link by combining with a carbon compound. Phosphorus could also be formed from silicon in a somewhat similar way, and nitrogen–carbon–phosphorus combinations would arise. The most primitive forms of living matter would be derived from such combinations. It is impossible at present to say whether this suggestion is a feasible one.

Now, protein molecules are sensitive to light, heat, pressure, desire, all of which affect our own senses. Are we therefore justified in saying they have no living qualities merely because their behaviour is so much simpler and more primitive than ours? We could not expect them to *think* as we do, but their behaviour denotes an *intelligent* endeavour to harmonize themselves with their environment by combining into more complex compounds and by the adoption of a different, a colloidal, character—a vital change from all that has gone before. Again, we cannot assume that the sensitive nature of proteins produced by the energy of the sun's rays acting through the medium of living organisms is in any way different from the sensitiveness of proteins developed from nitrogenous compounds formed by the energy of the sun's rays acting through the medium of non-living silica. They are both proteins, they are both composed of the same kinds of atoms in the same relative associations, they have the same labile, mobile, nascent condition.

Owing to the liberation of free oxygen into the atmosphere from the chemical action of these combining compounds, and to the formation of ozone, the ultra-violet rays have been cut off from the earth for millions of years, and the conditions which enabled the nitrogenous compounds to be formed under natural conditions will never again exist. Life, therefore, as we know it, can never again arise on our earth, and so its origin can only be conjectured; but there is enough evidence in other forms—evidence which is growing constantly with the research into biochemistry—to make the foregoing conjecture reasonable in the absence of any better one.

III

It is a long step from the sensitive protein molecule to the chlorophyll of the green plant upon which all existing plant and animal life depends. Yet there are certain organisms which even here help us to understand the possible transition between them. We have seen how complex colloids grow into vast groups, and by imagining how these would behave in an environment of enormous quantities of similar groups we see them rapidly building up and breaking down with the gradual isolation of that one which maintained its form longer than the others and which eventually became dominant. To this we must look for the changes which eventually became protoplasm—a protoplasm which existed before chlorophyll.

This protoplasm was formed by means of chemical reactions, which gave out heat during the chemical change. Existing bacteria which live on inorganic matter show somewhat similar reactions—in the oxidation of sulphur to sulphates by sulphur bacteria, ammonia to nitrites by nitrite bacteria, hydrogen to water by hydrogen bacteria. The energy liberated converts CO_2 to organic matter. Inorganic reactions of a similar nature would be able to achieve the same result without depending on any form of life to produce the necessary energy. In this way life would begin without the need of free oxygen, and the absence of air in the atmosphere would not prevent its origin and development. The first formed "living" things would again be large nitrogenous molecules synthesized (built up) from the complex colloids.

The ferments, vibrios, viruses, enzymes, bacteriophages, vitamins—living molecules—seem to be a sort of half-way house between non-living and living matter. All these are found in living cells and are produced by those cells, but they have little organization, and most of them consist of single protein molecules.

The viruses vary in size from 1/250,000 to 1/2,500,000 of an inch; a row of 2,500,000 of the smallest virus would be only one inch long, one cubic inch would contain 16 million million million of them. That the largest is ten times greater than the smallest indicates a considerable variation in constitution, and this may account for the great number of viruses with their different effects on animal and plant life. They do not respire, they do not develop heat, they can be concentrated into crystal form—but they are never found apart from living matter. They seem to be self-contained, self-reproducing living molecules, half-way between the inorganically formed hypothetical proteins and the simplest living organisms. They consist of one kind of nucleo-protein in the form of single giant living molecules, and frequently they are disease-bearing or disease-producing. The common cold, the potato disease, foot and mouth disease, infantile paralysis, small-pox, influenza, psittacosis, are all virus diseases. The same virus may also alter the virulence of diseases, as in cow-pox, small-pox, influenza. Some virus diseases consist of an unbalanced physiology due to the virus disintegrating the protein of its host and using it for its own purposes.

The vitamins are also single giant protein molecules, much smaller than the simplest bacteria. It is interesting to note that synthetic vitamins can be produced by ultra-violet light, which links them up to those proteins which could be produced from the combination of the compounds mentioned on page 219.

The bacteriophage is a single protein molecule the purpose of which seems to be to destroy bacteria—it must therefore have a specific nature adapted to this end.

Enzymes, again, are single giant protein molecules. They are produced by living organisms, but it is a moot point whether they may be considered to be alive or not. They are produced by glands and discharged into the blood-stream, and, though they do not divide to reproduce themselves, it is probable that they are in some sense living. These enzymes are of the greatest importance to life, for without them life would be impossible. They are soluble, colloidal, organic catalysts, this word "catalyst" meaning that they can bring about chemical combination, and speed up chemical action between compounds other than themselves, without entering into that action and without being themselves destroyed. They usually form on the surfaces of the internal structures of cells. The chemical nature of these giant molecules is not clearly known, but it must be remembered that they are composed of hundreds of atoms and, though the central organization is on the six-carbon-atom basis, these vast accumulations of atoms permit of many structures, each of which may have its special effect on living matter. Even the shapes they take may be of great importance, without any change of position of the atoms in the molecule relative to each other.

There seem to be enzymes for each kind of chemical action taking place in the cell. They assist in the building up and the breaking down of complex compounds. One breaks down glucose to carbon dioxide and water, another breaks down glucose to lactic acid. The clotting of blood is due to an enzyme; when it is absent a person is liable to bleed to death. The action of the enzyme seems to be to bring compounds close together and to force them to combine. One could liken it to a loom of organic action into which a weft of one compound and the warp of another pass, and are being ever woven into the fabric of life, the loom itself never changing. On the other hand the enzyme may seize a complex compound and compel part of it to break away—as, for instance, compelling water to leave a compound with the result that a simpler compound remains, together with the free water. Enzymes also carry atoms from one compound to another, oxygen especially, thereby causing a change in these compounds; and they can also alter the internal constitution of the large molecules.

The isolation of enzymes from individual persons and treating them with reference to the anti-toxins of different diseases would probably result in discovering special treatments for most diseases for any particular person, which if applied to all people would mean a striking improvement in the general health.

Hormones, the secretions of the ductless glands—thyroid, pituitary, pancreas, adrenal, para-thyroid, gonads—are forms of these giant living molecules, and these have as great an influence on the welfare of the organism as have enzymes, but their action is one of control rather than of chemical action only. Many of them can be manufactured artificially, apart from the body they control, which is of incalculable value for the treatment of those illnesses caused by the lack of hormones. The hormones are alive until they begin to break up, when they lose their individuality and their life ceases.

Living ultra-microscopic proteins may exist in hundreds of forms at the present time, but not until they express themselves in some manner which attracts our attention, as do viruses, enzymes, vitamins, etc., can we know of their existence. But those we do know prove to be almost all of one kind in so far as their chemical basis is concerned—a basis which approaches so nearly to non-living complex chemicals that doubt is frequently expressed whether they may be called alive. Research by means of X-rays shows that the intimate structure of living matter is similar to that of non-living compounds of primitive protein type—a testimony to the transition from non-living to living proteins.

How near this is to the origin of life! And how nearly these proteins produced by the living organism seem to be the link between living and non-living compounds! For who can say just where life begins or ends in one or the other?

IV

Let us now refer to certain organisms a little higher in the scale than these living proteins, organisms which are parasitic in the living body and cause disease. They are almost similar to the viruses in their effects, but are undoubtedly organisms, because they definitely reproduce themselves—a distinction which does not seem to apply to the single giant living molecules we have just been considering. These organisms are so small as to be barely visible under high powers of the microscope; they are specks of viscid matter without a clear limiting wall. They stain with the ordinary stains such as those which show up the minute bodies contained in the higher cells. An enzyme or ferment is produced within them which breaks up the chemicals in the surrounding environment and from which their proteins are built up. The method of reproduction is by division into two, the organism first becoming dumb-bell shaped, the narrow part breaking and the ends rounding off to form two new individuals. These organisms are known as Chlamydozoa; there are several forms of them which all seem to have been derived from biococci—minute specks of living protoplasm.

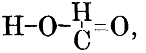
If these are compared with the enzymes, viruses, and other giant molecules, we find the principal difference to be that they regularly reproduce by the division of one individual to form two others. In order to do this, growth is necessary; not an inorganic growth, which means growth by accretion, but a growth by building up atoms into the body of the molecules, just as in the case of the growth of giant carbohydrate molecules and proteins. As such growth must have limits, the giant molecule must eventually collapse unless it reduces its size by division into smaller parts; it is more probable that such division should be equal rather than unequal not only because equal quantitative division is probable, but also because the smaller piece would need to grow considerably to reach the maximum size, while the larger one would soon attain the maximum, and it would be necessary for it to divide again very quickly, long before the smaller piece had grown to the full size again.

We must always keep in mind that complex organizations of whatever kind are derived from some structure simpler than themselves. So far as knowledge goes there is no exception to this sequence. Things are not derived from any non-existing source, nor are they derived by direct development from structures more complicated than themselves; progress is inevitably from the simple to the complex, and nutrient material must always be broken down to a condition less complex than the consuming body before it can be used as food. This applies to the evolution of the atom from pre-atomic sources as well as to living organisms.

The colloid group loses its organization when the energy of building up is less than the energy of breaking down; the whole group is disrupted and becomes the raw material for a fresh building-up process, or disappears as debris—that is, it disintegrates into simpler molecules or atoms.

But during the millions of years of colloidal change and development there comes a time when the colloid does not disrupt when the physical balance of these energies is destroyed. Instead the colloid group is able to replace lost energy by the energy of fresh compounds before it loses its organization. Inorganic compounds absorb energy during oxidation, and, if the colloid can in some way reduce (deoxidize) such compounds, the released energy is available to restore the energy equilibrium. Chlorophyll utilizes sunlight as a source of energy, and therefore the possibility of a colloid group using chemical energy in a similar manner is a reasonable supposition. This endeavour to attain equilibrium, or harmony, on the part of colloids may be the earliest expression of desire. There is certainly a definite attraction between the acid and basic ends of colloid molecules whereby colloidal groups grow to such great dimensions (see page 203). This is chemical attraction and perhaps occurs only by chance, but where there is a difference in electrical potential, as in the proteins, there may be a definite effort on the part of the colloids to move towards each other, because electricity can act across a space and the two need not be in actual contact before the effect of the electrical influence is felt.

In both cases, electrical and chemical, the colloid group can maintain its existence and can increase in size; it becomes much more stable as an organism, while at the same time energy changes are actively taking place within it, and it achieves bodily movement.

The chlorophyll just mentioned is a very complex colloid, and is not known apart from the green plant, which, though very primitive in the one-celled green alga, is still too highly organized to be a direct link between the living and non-living colloids; but chlorophyll provides a clue to the circumstances necessary for this link, because it uses the energy of the sunlight to break up water into hydrogen (H) and oxygen (O), and then to combine the H with the carbon (C) of carbon dioxide (CO_2) of the air in order to produce formic acid, $C(OH)_2$ or  $H{-}O{-}\overset{H}{\underset{}{C}}{=}O$, which is the carboxyl group, $H{-}O{-}C{=}O$, plus an H atom. On reduction, an O atom is released, and the remaining compound CH_2O combines with other hydrocarbon (CH) groups to form a six-carbon atom and thus a carbohydrate, starch, is produced. Air (which contains carbon dioxide and nitrogen), water, sunlight, and chlorophyll provide all the necessary factors for the production of life, and from the energy of the organic colloid thus produced is derived the energy which appears in cell activities.

The manner in which an inner and an outer layer could be formed during the association of the giant colloidal molecules has already been mentioned. Such a differentiation within this molecular association could easily pass to a more pronounced separation of the layers if this resulted in the association becoming more stable—that is, maintaining the greater harmony and persistence of this new form.

The physiology of such an associated group of colloids consists of the passage of food-stuffs through the outer layer; the selection of the food-stuffs by the inner colloids for the production of proteins, carbohydrates, hydrocarbons; the building of these up into the desired colloids; the intimate association of the old colloids with the new ones of the same kind. When the particular complex group formed by this process reaches a certain size, it cannot carry on the process any longer, because the volume of the group grows faster than its surface—just as in a growing sphere—in the proportion of four to three, and either disruption occurs—in which case the group is destroyed—or an organized division takes place whereby the group separates into two or more parts without losing the relationship between its different parts. The latter process is that of ordinary cell division, and therefore must have arisen sooner or later in the developing colloidal complex.

Now, look at the organization of the most primitive kind

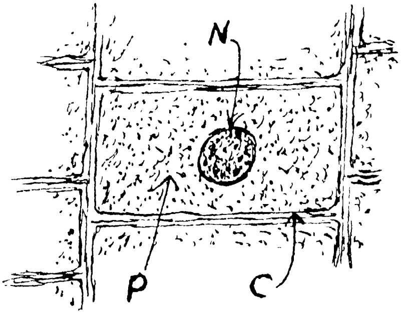


FIG. 5.—Young vegetable cell showing nucleus, N; protoplasm, P; cell-walls, C.

of cell we know (Figs. 5 and 6). It has a limiting membrane, a large amount of cell-sap within which many denser particles may be seen when stained, and a much denser central mass—the nucleus. The food passes through the membrane into the interior; the protoplasm absorbs the food and converts it into colloids similar to those within

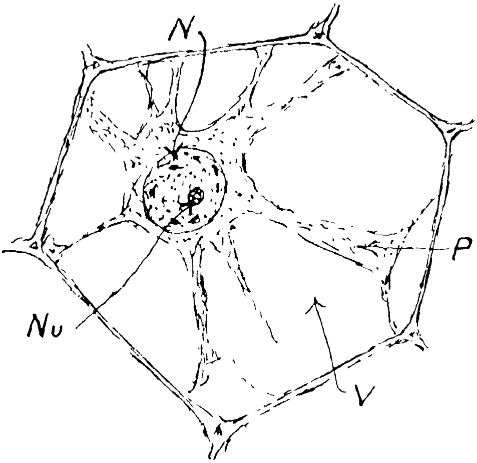


FIG. 6.—Old vegetable cell showing nucleus, N; nucleolus, Nu; protoplasm, P; vacuoles, V.

itself. The molecule of protoplasm contains about 2000 atoms and consists of several colloids co-operating together; the denser central mass absorbs such colloids as it requires; the cell divides into two.

Is there any difference between the associated group of colloids and this cell that makes such a transition impossible? Is there some mysterious change that cannot be accounted for, some interference apart from the organisms themselves? We do not think so.

V

One important feature of all cells may be mentioned here. At one stage in the life of the cell the nucleus seems to disappear and its contents are dispersed throughout the cell. It subsequently reappears as a long, thin thread called the spireme, and a thin nuclear membrane is formed having within it this spireme and certain cell inclusions. After further changes, mentioned later, the cell divides. Now, we suggest that during the dispersion of the nucleus its essential organization is never destroyed but it opens out in such a manner that it can absorb those protoplasmic colloids which have been prepared in the cell-sap. These it incorporates into itself, and the original substance of the nucleus with an equal quantity of the new substance become organically associated, so that when the spireme splits into two, the two parts are of one body and act and behave as the original nucleus did before this association. At cell division a spireme passes into each daughter cell, and thus the characters of the original cell are passed on to the daughter cells both as regards cell protoplasm and nucleus.

It may be true that the nucleus of the primitive cell arises as a temporary body out of the cell inclusions without there being any previous nucleus from which it was derived, or any special nuclear matter, but the true nucleus with its special organization and behaviour has undoubtedly arisen from such an accumulation of colloidal matter as has just been described, and eventually has obtained control over the cell to such an extent that the cell cannot divide unless the nucleus, or a portion of it, is present. It is this formation and division of the cell nucleus and, as we shall see a little later, the union of two cells for purposes of rejuvenation, that constitute almost, if not quite, the greatest advance Intelligence has made in the universe.

It should be mentioned that the presence of phosphorus distinguishes the nucleus from other cell compounds, and it may be that the phosphoric colloid, in converting the cell colloids into nuclear colloids, enables these to take over the "living" behaviour of organic matter, and so themselves become alive.

In parenthesis we must mention how difficult it is to determine what to leave out of this book. Important details can only be touched on because they are not definite breaks in continuity such as those we have called epochs, though they are essential to the immediate subject we are discussing—in this case, the emergence of life from the complex carbon compound to the nucleate cell. The mention of a cell membrane is one such detail. It is extremely important because of its control over the absorption of the food materials of the cell as well as its function of protecting the cell. We will be as brief as we can.

All cells are enclosed by a membrane which has three principal functions, one being to protect the cell contents from outer dangers, the second to pass food material from outside to inside the cell, and the third to pass waste products from inside to outside the cell. Food, as we have seen, consists of organic or inorganic matter—for instance, amino-acids, sugars, fatty acids, glycerine, oxygen, carbon dioxide, all of which must pass through the membrane.

This membrane is a very thin, jelly-like film secreted by the cell. Its structure seems to be gelatinous, and it is permeable to the substances just mentioned but impermeable to salts and some sugars. It must be permeable to waste products such as urea. It thus exercises a discrimination as to what it will allow to pass and what it will not; this may be some sort of chemical control. The substances which have diffused through are broken down in the cell and give up their energy or are built up into the substance of the cell—protoplasm, cell inclusions, and nucleus. All the important chemicals found in the cell—potassium, phosphorus, nitrogen, sulphur, calcium—diffuse through the membrane, this being the only means whereby the cell can obtain its food.

Although salts cannot pass freely through the membrane, they can disintegrate it, causing it to fail in the performance of its functions, and the whole cell will die in consequence; in effect, it has been poisoned. Ionized salts also affect its permeability.

As such an organized membrane is not found apart from the cell, it is evident that it must be formed either by the cell itself or it must have been originated as part of the cell during evolution, inasmuch as the cell cannot exist without it. There must be openings in its walls to allow of the passage of food and waste products, and one would expect that other substances of equal or smaller size would pass through, but they do not, and therefore the membrane must be alive and vigilant, or else it must be controlled by something inside the cell which selects for passage only those materials which advantage the cell.

At the same time the cell contents may have a strong physical urge for water, which may pass through the membrane to such an extent that the cell contents swell up and burst the membrane and the cell dies. This is a purely physical phenomenon called osmosis and cannot be prevented under certain circumstances, namely, when the concentration of salts in the cell is greater than that in the surrounding medium—a medium of pure water, for instance. If the concentration outside the cell is greater than that inside it, then water will pass out of the cell, which will collapse.

The point of this is that the membrane, as well as the cell enclosed within it, must have originated in a medium of approximately the same salt concentration as that of the cell itself. In its simplest form the membrane consists of a layer of protein molecules, then a layer of a fat-like colloidal substance called lipoid, two molecules thick, then another layer of protein molecules. All these are produced by the assimilation of food-stuffs in the cell and are placed in position by that living organized control of the cell which we call Intelligence.

The colloids are originally formed in water with a certain salt concentration, and the cell also originates and evolves in this water—the membrane, as part of the cell, being naturally adapted to function in a solution of this concentration. Any change in it is due to artificial conditions which tend to disorganize the membrane and destroy the cell. This concentration is found in sea-water and also in the fluid part of human and other animal bodies in which all cells are bathed, so it is reasonable to assume that organic matter originated in sea-water and that subsequent organisms, after becoming adapted to a life on land, had to carry with them water of the same degree of salt concentration as the sea if the vital functions were to be maintained. Hence blood tastes the same, or nearly so, as sea-water, any difference being due to the sea having become about four times as salty since such organisms left it. This increase was caused by the great rivers washing earthy deposits into it for millions of years.

That the cell has some control over the membrane is shown by the fact that if the membrane is slightly torn the cell can repair it. But if the tear is a bad one, the membrane splits all round the cell and the cell dies.

VI

To resume. In the primitive cell, the cell inclusions, apart from the nucleus, are few compared with those in animal cells. The cytoplasm has a framework of a substance named linin, and where the parts of this framework cross, or where they contact with one another, denser particles, called chromatin granules, form. The nucleus itself seems to be formed of a denser mass of this chromatin material supported on a similar sort of framework, but how far all this is due to coagulations formed in poisoning the cell in the process of preparation for the microscope, and how far they represent actual phases of the living cell, is perhaps doubtful. But without such preparations no observations at all could be made of the interior of the cell and nothing would be known of it; so the doubt is a question of the correctness of the conclusions drawn from the dead cell in relation to its living properties, and by no means a criticism of the value of such a method of research.

Moreover, recent methods of staining the living cell and of observing unstained living cells illuminated by ultra-violet light serve not only to correct errors due to staining dead cells but also to confirm most of the conclusions drawn from such staining. What is still more interesting, they have shown the contents of the living cell in action—twisting, coiling, coalescing, surging, dividing—a microcosm of highly organized energy intent on building a new being similar to itself but with those minute subtle differences which are the basis of change and which lead to the creation of new varieties and new species.

The principal organic differences between living and non-living matter are: the occurrence of the nucleus and the vacuole; the distinct limitations of chemical structure which result in the individual organized body; growth of the body to certain physical limits; formation of a definite limiting layer; division of the body into two similar bodies; transmission of the specific character of the body without disintegration when division takes place; tendency to variation of this specific character; response to stimulus indicated by the movement of the whole body towards food substances. Some of these are the natural physical consequences of the observed chemical action of colloids. It is highly probable—indeed almost certain—that these stages which are actual occurrences in the living organism originated between the colloid group and the first-formed protoplasm.

It must always be kept in mind that these progressive changes are the result of an endeavour to maintain the more intensive harmonies of complex associations of atoms and molecules. Whether the changes are due to accidental contactings or deliberate efforts makes no difference to the result; they are seized upon by the greater Intelligence derived from the combination and held in the new form as long as possible. They will break down a million times before reaching anything like a permanent arrangement, but that means little to the Intelligence of which the substance, the form, and the expression of the molecule, consist, because it formed the basis of these molecules—the mitron—many æons before matter had developed to this stage. If you say there is no such thing as an Intelligence of this kind, then it is for you to explain how and why these changes take place.

We shall continue to put our trust in Intelligence—" that which is aware of what it is doing "—for the present, and we shall credit it with that greater harmony which comes from the association and progressive development of complex bodies from simpler ones. Hence we conclude that the building up and breaking down of the associations of giant molecules led eventually to a stable form where the outer layer exercised some discrimination in passing to the inner layer such substances as it could profitably build up into itself. The cell membrane is a layer of such colloids, so this may not be very wide of the mark. And as all colloids are bathed in water, a vacuole situated inside the layers would be of advantage in providing a space where the central mass could select what was wanted from the substances presented to it.

VII

Before proceeding further to consider the living organism let us look at some definitions of life.

“ It is a power which builds up organized and highly complex structures possessing definite forms and functions from air, water and the substances dissolved therein. These structures are preserved in a continuous state of decay and repair by internal circulation of fluids and gases. They reproduce structures similar to themselves and go through various phases of youth, maturity, and old age, and then die and quickly decompose into their constituent elements. They thus form continuous series of similar individuals and, so long as external conditions render their existence possible, they seem to possess a potential immortality.”

Now another : “ The following properties taken collectively constitute life : assimilation, respiration, reproduction, growth, development, movement, secretion, excretion.”

Again : “ Life is a particular kind of activity which includes many chemical and physical processes, for instance, oxidation, fermentation, surface tension, osmosis, heat production, electric action. The control of these leads to behaviour which cannot be described in terms of chemical and physical concepts.”

Once more : “ Life consists of growth, multiplication, development ; effective behaviour, enregistration of experiences, evolvability ; compensation of breaking down by building up, metabolism of proteins, chemical individuality.”

Yet again : “ Life is a new aspect of reality which emerges in conditions of extreme complexity. It requires concepts transcending mechanics, physics, and chemistry for its description. It entails enregistration of the past, awareness of the present, purposiveness towards the future. Its growth is by active assimilation regulated from within the organism. Its behaviour in its higher forms is correlated with psychical activity incommensurable with physical processes.”

Finally, “ The essential and distinctive characteristic of a living body of any kind whatsoever is that it exhibits while it lives permanence and continuity of individuality or personality, as manifested in specific behaviour, combined with incessant change and lability of substance ; and further, that in producing its kind, it transmits its specific characters, with, however, that tendency to variability which permits of progressive adaptation and gradual evolutionary change.”

How far these various definitions really convey what life is and wherein it actually differs from non-living matter we will not attempt to discuss—each to his choice. In our view there is no fundamental difference between living and non-living matter. And is it so very clear what "life" is? Think it over for a few moments. It is not a thing or a function. There are living things, but there is really no entity of life. A person moves, but it is not life that moves; a sensation is carried to the brain, but this is a vibration, a physical, chemical, or electrical impulse or change—it is not life; the heart beats, the brain thinks, the hand writes—these are not in themselves life. Life is a word man has invented and used for indicating the action of parts towards themselves and towards other parts. It is said of a sick man that he has no life in him, whereas he is as full of it as any other person; what is meant is that his actions are sluggish or dormant. Life is thus but a name for the way in which things express themselves or behave, it is as intangible as space or time or Natural Selection; it is a succession of organic events and has no existence apart from the forms that exhibit it. "Eternal life," for instance, seems to imply that life can go on by itself, but it is an utterly meaningless phrase, because life appertains only to that which is living—if anything ceases to exist, life disappears. This is not a quibble, it is an endeavour to make clear what life means in order that such false uses of the word may be detected.

The only thing that distinguishes any particular group of colloids as living or not living is its behaviour—the attitude it presents to its internal and external environment. This behaviour is emphasized in the more complex colloids by the many changes made in the efforts to obtain food for its maintenance and growth, in providing protection against disagreeable consequences by ingenious means, in becoming aggressive with the urgency of its needs. Eventually this group of colloids emerges from the welter of primitive organic chaos as an individual unity with a highly organized structure, including a controlling nucleus, all enclosed in a flexible protective semi-permeable membrane. This is the unit of organic structure—the living cell.

VIII

The term "cell" was first given to plant-cells. Under the early microscopes the magnified tissues showed small box-like cavities to which this name "cell" was applied (see Fig. 5, page 227). The walls of these cells are very much thicker than the membranes we have just mentioned, and are formed as supports for the plant structure and for resisting the enormous pressures necessary in transporting water and food material to the tops of high trees. The cell membrane lies on the inside surfaces of these cell walls, the wall being pierced by fine pores through which the water and food substances pass and which enable the membrane to function in the manner before described. The food substances are carried to the leaves through a layer of somewhat thin-walled cells called the cambium layer.

Cells vary much in size, most of them being too small to be seen without a microscope. Yet the yolk of the ostrich egg is one single cell. The organization of the cell is something entirely new in the universe, and the difference between the most highly developed cell and the protein molecule which was its forerunner is so remarkable that probably no other change from one state to another is so great as this—not even the change from protist to man so far as life and organization are concerned. Nevertheless, an examination of the highest form of protein molecule and the lowest form of cell shows the possibility of a gradual transition from one to the other. The fact that the cell is composed of colloid molecules which exhibit properties similar in some respects to the inorganic colloids, and to certain substances produced in the laboratory from inorganic matter, makes this possibility a reasonable one.

The cell may be comparatively simple, as in the simplest protist, the primitive unicellular organism which is neither plant nor animal; or it may be so complex that it gives rise to all the structure, form, and characters of the highest form of life—mankind. This extreme complexity cannot be seen under the microscope and becomes evident only in the end products of the body it produces—mouse, oak, dog, daisy, dolphin, peacock, elephant, man. The development of these organisms from the cell itself by way of the embryo to the mature organism is well known.

In all cells except the most primitive, or in rare cases in some of the latest in development—as in red blood-corpuscles—the pride of place must be given to the nucleus. It is difficult to assess values in connection with organisms. The brain seems to be the most important organ in the body, but take away the blood, or any organ of the body, and what becomes of the brain? Almost everything is of fundamental importance; it is only our thinking that prompts us to give one organ more prominence than another. So it is with the cell; we are apt to give the nucleus a far higher value than any other part of the cell, but without the protoplasm and other cell inclusions the nucleus would disappear completely. There was protoplasm before the nucleus; there was organic form before there was a brain. Are nucleus and brain therefore more or less important than the cell and the body each controls? A purely academic question of no real significance, but it prompts us to exercise caution in assessing values of one organic part in relation to another, though for purposes of description, and of understanding the functions of the various parts of cell or body, we can conveniently give relative values, keeping this reservation in mind.

The nucleus is an essential part of the cell, and without it the cell cannot carry on its work. If a cell be cut up into small parts, any part which includes a bit of the nucleus will survive and form a new cell; any part without a bit of nucleus gradually dies. The bit with the nucleus can go on building up new colloids; the bit without nucleus can only go on breaking down its own colloids and living on them until they are exhausted. This nucleus may be observed as a spherical body within the cell, distinguished by its contents being denser than the rest of the cell at certain periods of the cell's life-cycle, at which time it appears to be surrounded by a very thin membrane. The nucleus is well shown when the cell is stained artificially, the nucleus absorbing some colours much more readily than does the main part of the cell.

The rest of the cell contains a thin transparent viscid fluid called cytoplasm—that is, cell protoplasm. When stained, a number of darker staining particles are observed in the cytoplasm, these being more numerous in the more advanced cells. The staining of cells is apt to be deceiving because the cells are then dead, and the killing and staining coagulate the contents in different ways, so that any conclusions drawn from the stained anatomy of such cells must be considered with caution.

At one period during the life of the cell the nucleus seems to disappear, to be dispersed throughout the cell, and the nuclear membrane vanishes. At another period the nucleus is very clear, and contains within it several bodies more intensely stained than the rest of it; these are the colour bodies, the chromosomes—the most interesting and important bits of visible matter in the organism. When the nucleus seems to disappear it may be assumed that its substance is dispersed throughout the whole of the cell and that there is a definite object in this. The cell is so small and its contents so specialized that there is no room in it for anything that is not vitally important to the cell's growth, development, and reproduction. Therefore the protoplasm and its more solid particles are all essential parts of the cell, though the nucleus seems to be the most important because of its power of reproducing the cell and because it contains

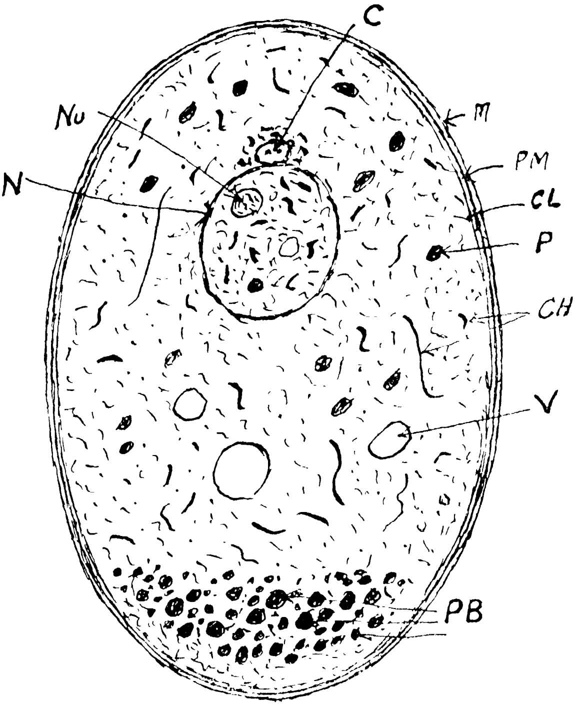


FIG. 7.—Highly developed animal cell showing nucleus, N; nucleolus, Nu; central bodies, C; membrane, M; plasma membrane, PM; cortical layer, CL; plastids, P; chondriosomes, Ch; vacuoles, V; plastic bodies, PB. The extreme complexity of the ordinary animal cell is evident in this diagrammatic illustration of the higher forms of cells.

those denser bodies that carry on the characteristics of the species.

Here, then, is a minute spot of organized living matter consisting of a membrane enclosing protoplasm within which is embedded a framework of linin threads with chromatin granules at its nodules, as well as a spherical nucleus consisting of a denser mass of chromatin (see Fig. 7). Not very complicated, seemingly, and a very trifling speck compared with the starry heavens; but from this homunculus arose something greater than the stars—namely, all the complex plant and animal cells and all the living organisms existing now and in the past upon our earth.

We have already mentioned how chemical action takes place inside the cell and how it is influenced by the enzymes. But how were the incoming chemicals endowed with life by the protoplasm? There must be some very extraordinary power in the protoplasm which can endow these chemicals with life when they have never been alive before. What is it, and how does it perform this creative act? Is it something which influences the chemicals as a magnet influences the iron with which it comes in contact, giving them life so long as they remain in contact with the source of life, as the magnet magnetizes the iron? Perhaps! But this would mean that all the chemicals would be lifeless until they were stirred into life from a source outside themselves, and that cannot be accepted.

IX

If there is Intelligence in everything, and if this Intelligence increases in magnitude with every progressive advance in complexity from mitron to pre-atom, pre-atom to the physical atom, atom to molecule, molecule to protein, protein to living cell, then when the cell takes in chemicals it is taking in this Intelligence, it is absorbing something which the cell already possesses, something entirely similar to itself except for their relative complexities, their special behaviour. And, in absorbing the chemical, the cell is adding the Intelligence of the chemical to its already advanced Intelligence and, by fitting the chemical into its own complexity, this united Intelligence enables the cell to carry on its functions, the incoming chemical merging its individuality into the formation of the greater complexity and combining its Intelligence with that complexity just as the whole cell merges its individuality into higher forms when it develops into or becomes part of such form.

We may conjecture that the food materials are seized upon by the cell colloids, which are of different kinds, each kind attracting food material suitable for its own purposes which it could build up into colloids similar to itself with the aid of enzymes in the manner described on page 223, thus maintaining the organization as well as the growth of the cell.

No colloid would grow to excess, otherwise the organized balance of the cell would be destroyed, and it may be that it is the duty of the membrane to reject certain chemicals when enough have been admitted to serve the purposes of the growth of each particular colloid. In this colloidal growth the food material becomes part of the colloid and takes on its behaviour. All the colloids maintain their correct relative sizes during growth until cell division takes place, when they are divided into two equal parts, one part passing to each of the two daughter cells. Thus the food material has been converted to a colloid, has become " alive," and has now become part of a new individual, and will carry on its functions just as did the original colloid in the mother cell.

The division of the cell is another remarkable phenomenon. It took many millions of years for the carbon colloid to attain the stage of cell division, and progressive development must have been going on all that time, Intelligence endeavouring to find fuller expression through the varying stages of this development and being baffled repeatedly by the circumstances of its internal and external environment, but eventually attaining its supreme triumph in this division which is apparently so trifling that it occurs millions of times during the life of complex organic beings of any size.

This division into two enabled the primitive organism to maintain its existence for a much longer period than had ever occurred before, each daughter cell being virtually part of the mother cell, and though separated they are really parts of one organic whole. But very slight changes, such as the absorption of a greater or less amount of certain chemicals, and the placing of these in slightly different quantities in different parts of the cell, or the greater organization of the membrane, enabling the cell to resist destruction due to physical or chemical changes in the environment, would alter the organic complex of the cell. These alterations would undergo division with the division of the general cell contents and so in time there would arise such differences as would bring unlikeness into the offspring of the original cells—an unlikeness that might eventually enable the younger generations to stand a better chance of survival than the older more primitive ones, and where these latter met difficulties with their environment they would be eliminated, while the younger ones would survive, and might even be strengthened by the difficulties they encountered because they would be more ready to change than their forbears.

The one-celled protista in their multitudinous forms represented organic life for some millions of years, but after a time some of them apparently found that they could resist destruction longer if they held together after they had divided. From this it was not a long step to several holding together in like manner and dividing while still retaining their group form, and thus began the arrangement of cells that led eventually to the higher forms of life. But the single-celled forms persisted, and still persist, as can be seen in any drop of stagnant water, though the primitive cell from which all these derived was undoubtedly much simpler in organization than present forms.

It may be that the development of the multicellular organism is on the margin of survival. The unicellular organism is well adapted to a certain environment, but where it comes into contact with an environment too harsh for it or which imperils its survival, the cell must retreat to its original environment or make some sort of adaptation which will enable it to exist under the more arduous conditions. The multicellular condition may be that change.

Or it may be that during the formation of the cell from naked protoplasm the encystment of the cell was never completed in those primitive forms which developed into the higher types of life. The waste products would form a more or less rigid casing about the living colloids or naked protoplasm as a protection against a destructive environment, but the protoplasm would remain connected by apertures in the casing. Thus there would be great masses of jelly-like protoplasm with perforated cell-walls in various stages of development. Parts would be detached by the physical action of the environment, as these organisms would develop in water subject to disturbances from winds and currents, and these would be the most primitive multicellular organisms; by repeated separation and isolation, organisms would form capable of holding together and of movement, crawling about after the manner of naked protoplasm and absorbing food in a similar way by means of the protoplasmic threads protruding through the pores in the casing. The attraction of food by some primitive chemical attraction or sense, as in the Amœba, would induce the group of cells to creep towards it, and so the movement of naked protoplasm would slide gradually into the movement of the multicellular organism. The unicellular organism would be formed by the complete encystment of some of the cells, such cells being cut off from the multicellular organism, and henceforth they would be independent individuals, but would have an internal organization similar to that of the cells forming the multicellular bodies; they would reproduce by fission. These unicellular organisms would in this event be later in time than the original multicellular organism.

CHAPTER XIX

CELLS AND ORGANISMS

I

EVERY organic being from microbe to man begins as one single cell—a cell which is endowed with an urge to attain harmony in its own special way according to its individual structure, its inherited tendencies, its external environment. It divides its substance again and again in the endeavour to satisfy this urge, striving against a thousand enemies which endeavour to destroy it. Only those cells which are in some way better fitted by constitution or activity, or those which by chance happen to be in the right place at the right time, attain an approximate harmony by reaching the adult form, but, even so, eventually succumbing before perfect harmony has been achieved—because as yet there is no perfect harmony anywhere.

These approximate harmonies may occur at the end of one division, as in the protista, or the cell may divide scores of times to form an enormous colony, becoming restricted in time and space with each division in order to perform special duties, and at length producing a co-ordinated adult organism as dinosaur, trilobite, whale, elephant, man, orchid, lily, daisy, frog—all end-products not only of cell differentiation, but, so far, of all evolution. But every such individual originates from one single organized cell, the zygote, with form and structure so minute that it can be seen only under a high power of the microscope, and these zygotes of different kinds of animals and plants are so much alike that even the microscope frequently fails to identify them and they can be classified only by observing the bodies to which they give rise.

To carry on the race the individual produces another single organized cell, the gamete, and between the zygote and the gamete there appears the soma—the body—which is generally considered to be the most important phase of organic existence. But, according to accepted theory, the soma is not included in the true life-cycle; it is only a side-issue thrown off at an early stage in the cycle and serves only to protect those special cells and tissues formed between the division of the zygote and the formation of the gamete.

These words " zygote," " gamete," " soma," are biological words used for indicating certain special cells, and the organic body. Many scientific words are adopted from Greek and Latin sources in order to enable scientists of all countries to understand their meaning without translating them from one language to another. But some of these words are very useful for ordinary purposes when they are limited to particular objects. The human body contains about one thousand million million (1,000,000,000,000,000) cells, but the word " zygote " refers to one single cell out of all this vast number, and the word " gamete " refers to the cells of one group with a very special function—that of producing the next generation. The gametes, or germ-cells, have no direct connection with the cells of the rest of the organism; they are of two kinds, one produced by the male organism and the other by the female, the former being the " spermatozoon " and the latter the " ovum." In order to produce another organism, a male and a female gamete must unite, and in doing so they coalesce into a new cell, the zygote. From this one cell the new organism arises. The word " gamete " is derived from the Greek word " gameo," meaning marriage, and " zygote " from the Greek word " zugosis," meaning joining. The cells indicated by these words can never be confused with other cells of the body.

Again, the word " body " is used for many objects—the human body, the body politic, the body of the hall; wine has body, the sun is a heavenly body, and so on. The word " soma " is the Greek word for body, and has been adopted by biologists to mean the human or other organic body thus distinguishing it from all other kinds of bodies. The soma arises from the zygote which divides into two cells, each of which divides again, and these yet again, this division going on actively until the mature organism—the soma—is formed; this may be a mouse, man, fish, grass, insect, etc. Thus these three words have clear, definite, useful meanings. The cells of the soma are the " somatic " cells.

Generally speaking, these three distinct cell groups—zygotic, gametic, somatic—are essential phases in the life-cycle, but sometimes the zygote is cut out, the gamete being able to produce the soma without the intermediary zygote. This is rare, and is called parthenogenesis, but in a few animals and plants of lowly form it is the usual method of reproduction. Gamete, zygote, soma, is the usual sequence. The protista—unicellular organisms—the most primitive forms of life, are potentially immortal because they consist of only one cell and reproduce by division, thus producing two cells, each of which is another complete organism, yet is part of the parent cell; apart from accidents, the one cell, repeatedly splitting up again and again, never dies. This also applies to the gamete, but accidents are so frequent that, under normal conditions, of all the millions of reproductive cells produced by any organism, be it mammal or protist, only one in the case of the protist and two in the case of the mammal (because two individuals are necessary to produce one individual) arrive at maturity. If this were not so, then one kind of organism would increase at a higher rate than the normal, and very soon this would become dominant and monopolize the earth. The obvious checks to this are the lack of sufficient food if they became too prolific, enemies who use them as food or who destroy them, or disease.

The somatic cell is *not* immortal; organic death in a comparatively short time is inevitably its portion. But it is protected by the soma produced by it, and only the destruction of the whole soma will destroy its cells outright. In the economy of the organism some of these cells are frequently eliminated during its life, but the soma retains its form and structure until general dissolution occurs.

One thing should be kept vividly in mind. You who read this, whatever you may be—king (not likely), bishop (less likely), scientist, artist, craftsman, labourer, tramp—were only a little while ago one of these zygotes. Fig. 8 is a magnified picture of you as you were a few years ago. You were so small that you could be seen only under a microscope and your structure could not be made out at all until you were killed and stained and mounted on a slide—but, of course, that wouldn't be you, or you would not be reading this, though it would be some one indistinguishable from you at that stage of your existence. So call it you—it will give a personal touch, and may create more interest in what follows if you think all the time: "So this is me!"

This pin-point of matter consists of a group of molecules, as much a human being as you are, organized in a certain way—you are only bigger and apparently more complex. These molecules have in them the sources of your body—heart, lungs, brain, blood, bones, nerves, eyes, muscles, the shape of your nose, the lines on your hands, the expression

FIG. 8.—The speck in the middle of this page is 30 times as large as you actually were in your zygote stage. Fig. 7, page 237, shows your organization at this stage.

R

of your emotions, the limits to your thinking—all in this minute spot of viscid matter. Look at the illustration again! Is it not more wonderful than even you, inasmuch as it contains all your possibilities, all your Intelligence, in such an infinitesimal compass? When we are inclined to doubt whether Intelligence can have arisen from mitrons this solid fact should renew our confidence.

But are these only molecules and nothing else, ordinary molecules grouped in a confined space? Such a suggestion is obviously absurd. Take some organic molecules of exactly the same kind as these and mix them together; will they produce a man, or anything else greater than themselves? There is a profound organization in the cell which as yet is beyond our understanding. This has developed through thousands of centuries from protoplasm to man by action between organism and environment. Without an environment there can be no organism, and this organism, though constructed of molecules, has something about it which is vastly in advance of chemical molecular combination. The destruction of one of them severs a link that reaches back without a break to the very origin of the universe, and from this we must conclude that organization of some kind has accompanied all assemblages of molecules, organic and inorganic, from the simplest type of crystal formation to protoplasm.

II

The atom has physical and chemical properties; has it any properties of life? If we say "No," then life must have existed apart from the atom and then attached itself to atoms, because the body is composed of nothing but atoms—and this attachment must have taken place after the formation of the atom. If atoms are not alive, then what does that which we call life consist of and where is it situated in the body? Is it attached to any group of atoms or any particular kind of molecule? Or is it in the blood, or in one or more organs, or in the brain? If it is situated in the body as a whole, what does this mean? Is it in every particle of the body? If so, it must certainly be in the atoms of which the body is composed; so if it is not in the atom it seems impossible to say where it is. But if the atoms have life it must be in all atoms; it cannot be in some and not in others. This would mean that all atoms have life, and organic life is a complex development of atoms in the organism. If the mitron exists, then by the same reasoning life is a property of mitrons, and, as mitrons are Intelligence in motion, life is Intelligence.

So again we are driven to assume an Intelligence—for we must call it that—if any explanation of organic development is to be found; and this Intelligence is linked up with our own, just as our brain and nervous system are linked up with the cell from which we developed a few short years ago, and with the molecules within that cell—and so step by step back to the beginning again. We can thus begin with ourselves just as we are, writing or reading this book, and trace our own Intelligence back to our own zygote; or we can begin with ourselves as the end product, so far, of an Intelligence which we can trace back through our parents, our ancestors, our animal progenitors, our origin as protoplasm, the molecules which preceded protoplasm, the atom, the mitron, and, preceding that, to the universal Intelligence which resided, and which resides, in the matrix of the universe.

To return to the organism. The parental characters of the soma are united when the two gametes coalesce to form the zygote. Gametes are highly organized cells and, when uniting, the corresponding parts of each become linked together. In subsequent cell divisions these linked parts divide also, thereby maintaining the organization of the cells within the soma all through the cell generations from the zygote to the gametes. In most of the somatic cells this internal organization of the cell persists, though the speed of cell production changes with the needs of the different parts of the growing embryo.

The zygote usually begins to divide immediately it is produced. It is not generally understood, and where it is understood it is not generally appreciated, what an enormous industry follows the formation of the zygote. A highly organized factory is trifling compared with this immense activity. There is a tremendous surge towards the adult organisms, slowing down in some places and speeding up in others until this is reached; everything being guided, down to the most intimate and minute detail, by the Intelligence of the organism. From this one single cell there develop, among other things, bones, muscles, limbs, toes, fingers, heart, lungs, intestines, ears, tongue, eyes, brain, glands, nerves, about 30,000,000,000,000 red blood-corpuscles, 9,280,000,000 brain cells—in all about 1,000,000,000,000,000 very highly organized cells which in nine months form the human body; the capillaries that link up vein and artery would if placed end to end extend two and a half times round the earth. And a wonderful harmony accompanies the development of the embryo during these phases. Everything goes smoothly, though growth is so rapid, and the changes in the cells and their disposition are almost incredible. The Intelligence which governs racial development has already been mentioned, and this must also control embryonic development. If not, then Intelligence begins at birth, and all that remarkable development between zygote and birth—perhaps the most essential period in the life-cycle—is not intelligently controlled, but is due only to some sort of physico-chemical action not yet understood.

When the zygote divides there are changes in the organization of the subsequent cells from the very first division. It is stated that one of the two cells is set aside for producing the tissue from which the gametes are derived, while the other divides to produce the soma. This statement is probably incorrect and will be referred to later (page 259). But gametic tissue is certainly set aside very soon in development, and remains dormant until the organism attains maturity, when its activity—the production of gametes—begins. The zygote, or fertilized ovum, remains in the body of the female, gradually developing until it reaches the stage when it is able to survive in an external environment; during this development it is known as the embryo. This refers to man and other mammalia; the lower animals generally develop partly in the body of the female and continue their development in eggs outside the body.

Organisms having two parents can never be exactly like either of them. We say a child is like its father or mother, but this is a general, not an exact, likeness. The reason is that the germ-cell of each parent has the general qualities of that parent, and the two parents cannot be exactly alike, which means that their germ-cells are unlike. Their union produces offspring unlike the parents, yet blends the characters and forms of both. Thus it has likeness in some details, but must necessarily differ to some extent from each. Hence the phrase, " like *tends* to beget like," not " like begets like."

The zygote is the axis upon which the organism turns. It seems to gather up within itself all the complex development between atom and organic molecule and yields them up to become the still greater complexities of organic beings.

It is much more marvellous than the whole of the rest of the world put together, and the more it is studied the more incredible and mysterious it appears. Yet it is us; we are derived from it, and we contain it in our own bodies; but we need not be too proud about this, because every blade of grass, every cod fish, every beetle, every monkey, derives from a similar cell.

There must be something very remarkable about the relationship between the zygote and the somatic cell. The unicellular type of organism must have altered in some way in order to produce the multicellular soma; there must have been some advantage in cells remaining united after division. If this meant an advantage or an aid to survival it would become a habit, an hereditary condition. The first event would be the two cells remaining connected when division took place. If this proved advantageous it would be easy for the next division of these cells—four in all—to keep in contact, and also the eight formed by the next division. They could remain as an undifferentiated group, or they could join end to end and remain connected, thus forming filaments—a very common form of primitive plant life, the algæ. Or, if the division happened to be in one plane, a thallus or plate of cells would be formed, and this also occurs. These simple groupings may consist of cells in contact but independent so far as individual internal organization is concerned, the attachment being merely the contacting of the cell walls—a purely mechanical arrangement, not a truly multicellular organism—and would entail no great step in development. In such an association of cells every cell may break away and, by division, form another group. But the division of the original cell may result in an incomplete severance of the two resulting cells, and protoplasmic continuity may be retained. This is a very great advance, the individual then consisting of two cells in organic connection. The association of two such cells must have meant an advantage in survival by greater ease of living or by some larger control or greater harmony with its changing environment. Later, there seem to be emergent factors which advantage the organism still more, and there appear changes in the method of reproducing the cells.

III

With the increasing urge to survive in a changing environment a differentiation in the cells gradually appears. It begins by some cells becoming attached to one another, the protoplasmic contents shrinking, the cell walls breaking down, and the protoplasmic contents uniting. The cell walls then form round the united protoplasms, the result being one single cell about twice as large as the former ones, containing the fused contents of the two (see Fig. 9). This process is called conjugation and is the most primitive form of sexual reproduction; in the earliest organisms there is no distinction between the uniting cells, and sex differentiation has not yet begun. In some species, two free cells unite, one casting off its cell-wall and the other one repairing the break after the entry of the protoplasm from the first one. Sometimes two cell filaments may lie side by side, and the cell-wall of one cell in one filament will break down allowing the contents to pass into a cell of the adjacent filament, the cell-wall of which has broken down to admit the protoplasm; the cells of one filament will then have double the quantity of protoplasm, while the other ones are empty. This is found in the green algæ.

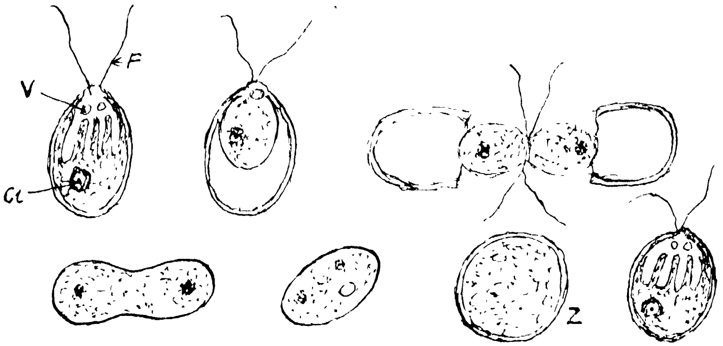


FIG. 9.—Chlamydomonas. Reproduction by conjugation; earliest form of sexual reproduction. Contents shrink, cell wall splits, and contents escape. Two cells unite, flagellae are withdrawn into protoplasm. Resulting single cell becomes rounded off, nuclei unite, new cell wall is secreted, the whole forming a zygospore. This reorganizes into a mature Chlamydomonas with flagellae. Cl, chloroplast; Z, zygospore; F, flagellae; V, vacuole.

A little higher in development two groups of cells are *differentiated* from the main body of cells and become specialized for the purpose of producing a new organism similar to the one originating them. These are quite different in appearance and function from the main body of cells and from one another. The cells of one group are very small compared with those of the other, and their function is to penetrate the larger cells, so that the *nucleus* enters the cell and fuses with the *nucleus* of the larger cell. By this union the combined cell is stimulated to divide and produce a new organism. What is understood as "sex" begins here, for this is the first differentiated sex cell, the small one being the male gamete, and the large one the female gamete, the resulting union being the zygote.

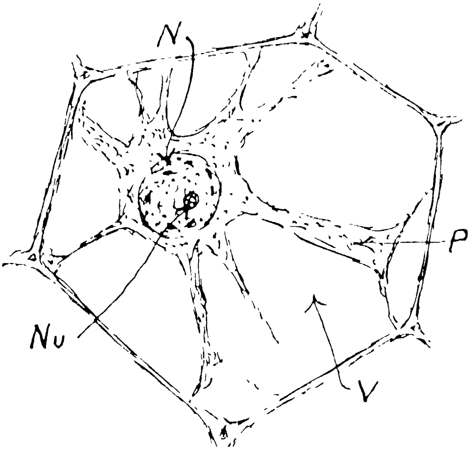


Fig. 10.—Old vegetable cell showing nucleus, N; nucleolus, Nu; protoplasm, P; vacuoles, V.

Here we find necessary death entering the universe for the first time, because the organism which produces these differentiated cells must die sooner or later, while the differentiated cells carry on the torch of existence and possess that potential immortality mentioned before. It is through this new kind of cell that man's ancestry may be traced back without a break of any kind to the first mitron that separated out from the matrix of the universe. Here is repeated the diagrammatic sketch of a cell so that we may know what it is we are discussing (see Fig. 10).

All cells contain a nucleus in which chromosomes are situated and, when the cell considered in the last chapter *divided*, the chromosomes split into two parts, each set of these "half" chromosomes passing to opposite ends of the cell, the cell membrane closing round them, and two new

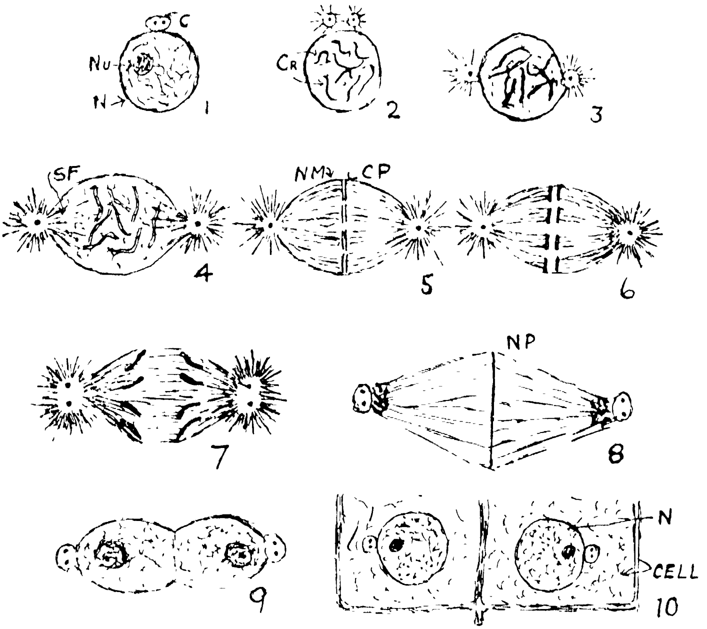


FIG. 11.—Nuclear division of animal cell. (1) Nucleus, N, with nucleolus, Nu, and centrosomes, C. (2) Centrosomes separate; nucleolus is absorbed; chromosomes, Cr, stain deeply. (3) centrosomes move to opposite sides of nucleus. (4) Centrosomes induce spindle fibres, SF, to form in protoplasm; chromosomes split longitudinally. (5) Chromosomes gather into central plate, CP; spindle fibres seem to be attached to chromosomes; nuclear membrane, NM, disappears. (6) Chromosomes are separated into two sets of half chromosomes. (7) Chromosomes travel along spindle fibres towards centrosomes; centrosomes divide into two. (8) Chromosomes gather together at ends of fibres; centrosomes lose their rays; spindle fibres are absorbed; nuclear plate, NP, forms. (9) Chromosomes lose their definite shape; nuclear plate is completed; nuclear membrane forms. (10) Nuclei round off; nucleolus appears; cell-wall forms round nucleus and the cell protoplasm. In 5, 6, and 7 only half the number of chromosomes are visible.

cells being formed, each with the same number of chromosomes as that of the original cell, these chromosomes growing with the cell to the full size as in the parent cell (see Fig. 11).

But when two gametes *unite*, the chromosomes in each are added, and in the resulting zygote there is double the quantity of chromosomes contained in the single gamete. This double number persists in the somatic cells formed from the zygote; and in the layer of tissue from which the gametes are formed all cells have this double number of chromosomes. If no change in number takes place, when the gametes of the next generation unite, the chromosomes will be quadrupled. If the first gametes have four chromosomes each, the zygote formed from them will have eight; the union of two gametes each with eight chromosomes will produce a zygote with sixteen, and the next zygote will have thirty-two. In a few generations the gametes would have thousands of chromosomes. What actually happens is that during the formation of gametes from gametic tissue the number of chromosomes is reduced to half—this is called the "reduction division" or meiosis—so that the eight chromosomes in the zygote and the somatic cells are reduced to four in the gamete, and when these unite the eight appear again. The full number is called the diploid number and the half number the haploid number.

When the embryo mentioned in the last section is completely developed it is separated from the mother, and sets out on its independent journey through life, eventually becoming adult—that is, sexually mature—and thence living the normal life of the species until accident, disease, or senility puts an end to it. But why does the zygote set out to produce the embryo and the mature organism? The scientific answer would no doubt be that it is unstable, and there is within it an urge to change its condition and to divide, this change being repeated in every subsequent division and following a certain predestined course. This explains nothing—it just assumes causes and conditions which are impossible to understand in order to account for an observed regular sequence of changes. There is another answer to this question—namely, that there is a disharmony in all material things and an Intelligence in these things seeking to remove this disharmony and replace it by universal harmony. In order to do this all things in disharmony must change if they are to remain in existence, and these changes are induced and guided by that particular Intelligence which has grown up with, and has anticipated, these changes. So whether it is a primitive atom changing to a complex atom, or inorganic matter changing to organic matter, or a zygote changing to an adult form, this principle holds.

How does Intelligence exist? We have already stated that it preceded all matter, this being the form it takes in its pilgrimage towards harmony. Matter is not something on which Intelligence acts, it is Intelligence itself which, through the constantly increasing complexity of matter, is reshaping itself towards an equilibrium which means harmony. Thus it anticipates change according to local circumstances, to the incidences of its environment, but change follows anticipation so readily that human observation cannot distinguish between them. All matter, inorganic and organic, may be termed the accidents of Intelligence; there is no premeditated sequence, and change may take place in a fraction of a second or in a million years.

So when two gametes unite to form a zygote there is a union of highly organized Intelligences setting vigorously to work to bring about a harmony which is partially achieved with the formation of the adult organism. This is in a much more complex environment than that of the zygote, and the differentiation of cells following the division of the zygote has for its object the provision of an organism which may survive in this environment long enough to ensure that the cycle of life is complete—*i.e.*, that its inevitable dissolution does not entail the extermination of its long lineage; hence it forms gametes to carry on the stock. Its adaptation to the environment, which enables it to survive, brings about extraordinary changes for which no "laws" can account, and perhaps the most remarkable of these is the development of an organ—the human brain—which enables the organism to understand its own activities and the activities of other organisms quite remote from itself, and the relationships between organic and inorganic activities. If, then, this Intelligence is accepted, even only as a working suggestion, it will account for all the changes in the zygote and the resulting development of the adult form. Until a more consistent explanation of embryonic development is forthcoming we shall hold to our thesis that an organized Intelligence resides within and is part of the organized cell, that it is in the chemicals of which the cell is composed, that it is in the atoms which form the chemicals, and so we return once more to that beginning which has been mentioned so often.

IV

The development of the embryo is very important to our theme. The difficulties of understanding how organic forms could have originated and developed either by the aid of an external power or by internal mechanical and physico-chemical responses to an environment external to themselves, with the adjustments necessary for them to maintain a continuous existence in that environment, will be more appreciated when the complexity of the embryo and its development are examined.

Any directive, selective, formative, or constructive power which controls or guides the division of cells in such a manner as to form organs, nerves, glands, muscles, etc., must act from within or without. If from without, then this power must be active in forcing or inducing the chemicals to grow in the necessary way to the required extent, then to force or induce the cells to divide in the right manner at the right time in the right position so as to produce that growth and form particular to the species. It must continue to produce these all through the life of the adult, and it must control those cell divisions peculiar to the production of the gamete in such a manner as to ensure the development of a body similar to itself by means of the gametes.

What is the source of this power and what means does it adopt to enforce these chemical growths and physical divisions? What mechanical control has it over these operations? It cannot just be present and order them to act in these ways; it must not only have some sort of being, but it must also have some sort of physical and mechanical control and some knowledge of what it is doing and why it is doing it. It cannot just blunder along blindly. It must, in fact, be some sort of material power. Where does such a power reside and how does it exercise its authority? It cannot act without any objective whatever. We have endeavoured to show that such a power cannot exist outside the organism; hence if it exists at all it must be within the organism. Look at it another way. As cell division continues more chemicals are absorbed and growth continues. But the cells differentiate, they become unlike in their internal organization and in function. How does this differentiation arise from the absorption of purely chemical compounds?

No inorganic forms of matter are able to produce these remarkable effects. Whatever form of energy is applied to inorganic matter, nothing but similar inorganic matter is produced whatever natural law controls it. Therefore if these cellular differentiations are purely physical and chemical they must be under the control of some new law—a law which did not operate before these differentiations took place in the development of organic forms. Was this law already existing in nature, awaiting the time when the first organic form appeared? If so, then it must be assumed there are laws in nature awaiting all kinds of changes in organic matter. Where are these laws? Are they controlled by anything, or do they just happen and then apply themselves to matter when matter has assumed the form which compels it to obey these laws? Or did these new laws arise as and when the new forms appeared? They could not arise *before* the new forms, because they would have no object in doing so—they could not know before they existed that they themselves would come into existence as soon as new forms arose; hence they could arise only simultaneously with the new forms of development. That is to say, they were somehow specially created immediately the new forms appeared, in order to make these forms obey their powers, and this special creation must be external to matter. But this we have ruled out.

In either case, at what point in the change from the inorganic to the organic did the laws begin to act on organic forms? Up to the time of this change the laws of inorganic matter have presumably sufficed for all physical and chemical action; such laws do not cease to operate when organic change takes place; they still hold for the inorganic part of the organic form, so the new laws must act in co-operation with the older ones—quite naturally, as any chemist or physicist will allow. But at what precise point do they interfere—carbon compound, colloid, enzyme, or where? And, with the greater changes in the higher forms, do additional new laws still arise to cope with the new phases of existence—new changes such as vegetable to animal, invertebrate to vertebrate, marsupial to mammal, unconsciousness to awareness, nervous reflex to thought? Or must we go back on our tracks and assert that by its own efforts, made under preorganic natural law, inorganic matter is able to produce *a single microscopic organic cell* which controls the development of all the infinite complexity of the higher forms of life together with the laws that arise with them, while the cell itself ceases to have any connection with these forms after it has divided into two cells? This gratuitous, unproved assertion will need evidence which is not yet available before it can be made with any degree of confidence or success, and the more the facts are examined the more impossible this explanation appears to be.

Does all this talk about new laws sound silly ? You know already (see page 169) our opinion about laws, and our apology for such persistent questioning must be that only in this way can the weaknesses of accepted interpretations be accentuated. In this instance, organic matter grows, develops, behaves according to fixed laws which existed before it was first formed, or which came into existence contemporaneously with the origin and development of organic matter and its behaviour (the law of regression towards mediocrity, the law of complexity, the law of evolution, the law of natural selection, the law of inheritance —how important they sound but when analysed they prove to be but the statements of what happens to individuals or groups of individuals, not of what *must* happen to *all* individuals), unless there is within all organic matter, guiding and controlling it, that same Intelligence which originated, and which is, the universe.

V

In the development of the embryo the zygote divides and the subsequent cell generations divide again and again, and it should be noted that these cells do not just divide, grow, and divide again, but they *alter their positions* relative to each other ; some *grow faster* than others, *new kinds* of cells arise, cells with *different functions*, and the end product of all this is a youth form of something so unlike the single cell which originated it that the transformation seems miraculous. How do the embryologists explain or account for these transformations ?

Let us examine the scientific answer. First, certain changes take place in the zygote, and it eventually divides. The changes control the division, but presently the subsequent cells begin to alter their positions relative to one another, and then groups of cells, whole tissues, move and slide and grow and form and re-form. This positional growth is something entirely unaccountable ; how can an internal change inside a cell make the whole cell bodily change its place relative to other cells ? But the tissues link up to one another and new tissues form out of them, tissues which become organs having very widely different functions—pumping, secreting, expanding, contracting, absorbing, selecting, purifying, excreting. How can all these be produced by changes *inside* the cells from which they were derived—changes that were initiated in the zygote if the gene theory is correct? The scientist tells us that certain parts of the young embryo act somewhat independently of each other, and there is in each something which seems to instruct them how to grow and divide and adopt functions different from each other. Each part has a centre of development, an " individuation field," which is stirred to action by something apart from it, called an " evocator." The cells so acted upon produce a tissue of similar cells, the whole being an " organization centre " controlled by something else called an " organizer." Where these were originally situated in the embryo, or how they exercise their powers, is not stated—they just *are*—and this is the way they control the intricate development of the embryo. The individuation field determines how the tissues link up together and they originate other individuation fields which carry on more detailed development. At the original organization centre the organizer determines the lay-out of the embryo, and as each part grows the first organizer passes on its powers to subsidiary parts—a sort of delegation of authority—so that each has its own organization centre as well as individuation field. Both the organizer and the individuation field are called " determiners." Besides these there are in some embryos " activating centres " and " activating fields."

It will serve no purpose, and may be tedious, to go into the detail of all these evocators, determiners, organizers, individuation fields, organization centres, differentiating centres, activation centres, some separating to form others with the same powers, some disappearing after they have served a definite purpose. It shows only how science has had to deal with the development of the embryo in order to give any rational account of how this development takes place. Science is compelled to admit that these are nearly all very hypothetical, and even the embryologist, after inventing these powers, asks naïvely whence they come! He himself does not know, and it is all really a confession of ignorance, but a gallant attempt to formulate logical ways of accounting for observed facts—facts so strange that no existing theories may be applied to them. It is reasonably possible that the efforts of the embryologist will be crowned with success and a perfectly sound scientific explanation given for the development of the embryo. We hope this will happen soon, as it would be another step along that great highway of truth which science is ever extending into the abysses and sloughs and mountain-tops of ignorance. We believe it will bring them nearer to our principle of Intelligence, for the more the enlightenment, the more a fundamental truth will shine out upon the world. And if it leads away from Intelligence—well, so long as it is nearer to the truth, that is all that matters.

It may be interesting to follow the cell and its development into the adult organism, and cell change in connection with the relationship of organisms, including man, to their environment. It may also help towards understanding the connection between the genes and the adult organism, and the attempts to elucidate these problems.

VI

There is great controversy about what happens in the *daughter cells* formed when the zygote divides. At one time it was thought that one of these two cells was set aside for the purpose of developing the tissue from which the next generation of gametes is produced, while the other developed the soma, but this has proved to be untrue, because in the first place the series of cells between the first daughter cell and the subsequent germ-layer tissue cannot be traced clearly, and in the second place, complete individuals can be formed from *each* of these two daughter cells and in some cases from *each* of the four cells resulting from the division of the two daughter cells. If individuals, complete with gametic tissue, can be developed from *each* of the two cells of the dividing zygote, then one of these two cells is quite definitely not set aside to produce gametic tissue only. The cells from the third generation, however, definitely begin to differentiate, so it is reasonable to assume that this differentiation really begins with the first division of the zygote. If there is no differentiation until the third division, then the first four cells are alike in every detail of organization and function, and any subsequent differentiation must be due to some external interference taking over control when the third division takes place; this has been ruled out in the foregoing chapters and is not asserted by anyone. It will be referred to later.

The first result of the dividing zygote is a sphere of cells.

Two roundish cells are first formed, and these divide to form four similar cells; division, or cleavage, takes place again and again, the cells being all spherical and attached to one another, the result being a ball of cells, the periphery consisting of one layer of cells enclosing a comparatively large space, just as in an ordinary rubber ball. This is the "cleavage" stage, and is followed by the cells again dividing, but they now become more compact; something has happened or something has taken control, the cells losing their spherical shape and becoming approximately brick-like or cubical. This is the earliest form of embryonic change. In some embryos only a portion of the sphere produces these cubical cells, the other producing a quantity of yolk on which the embryo feeds until it reaches the stage of becoming an actual living animal. In the eggs of birds by far the greater portion of the sphere consists of yolk. This is the "blastula stage."

The development of the embryo from this stage becomes very intricate, and many attempts have been made to account for the manifold changes taking place. The blastula becomes a "gastrula" by the sphere becoming indented (just as the periphery of a rubber ball may be pushed in if there is a small hole in it), until it forms a cup of two layers of cells. The cells of the gastrula then divide to form four groups of cells, which eventually produce the skin, the brain and nervous system, the muscles and skeleton, and the heart, lungs, liver, gut, and other organs. They are formed very quickly, though growth becomes even more rapid as the embryo develops. The parts differentiate within themselves, and gradually the embryo becomes shaped into the youth form of the adult animal; it has produced those 1,000,000,000,000,000 cells before mentioned.

There is some difficulty in understanding the production of the embryo, because in some cases the development of the same character in different animals does not arise from the same layer of cells in the gastrula. For instance, the thymus in a small marsupial, *Trichosurus*, is derived from both ectoderm and mesoderm; in the mole it develops from the ectoderm only; while in man and rabbit it is derived from the endoderm. How can this be explained? At present there is no satisfactory explanation, and so an "organizer" is assumed to control it and to produce the thymus *from any convenient material* in the primitive cell layers. This plays havoc with the gene theory, but enormously supports the principle of Intelligence.

When birth takes place practically all the cells are formed, and subsequent growth consists of the enlargement of these cells, not the production of new ones. Length of life is usually considered to be the time between birth and death; but the most important part is the time between the first division of the zygote to birth, for during this period all the cells, muscles, bones, organs, nerves, are being formed, together with character, personality, emotional complex, and most of the other phases of youth and adult life—all that follows is but the expansion and expression of these forms, relations, and qualities.

This embryonic development is a vast preparation for meeting with the circumstances and conditions of life in an exterior environment; the growth and adjustment to events which have never before been experienced by the individual. It is an equipment for a great and wonderful adventure; no matter whether one is king, warrior, priest, craftsman, serf, the preparation is the same for everyone without distinction—the embryo responds only to racial inheritance, it knows nothing of classes and clans, ruler and ruled, sinner or saved. And this applies to almost all other forms of life as well as to man; the root and shoot of the plant, the larval forms of fish and amphibian, egg into chicken—all derive from embryos in which lie the qualities and forms of the race.

It may seem that Intelligence is working blindly when the changes in the position of cells during the growth of the embryo are observed. An embryologist may experiment with cells, nerves, muscles, organs, cutting and grafting pieces of one organism on to another, but when the primitive stages of growth gradually formed the primitive organism, no higher organisms capable of examining and studying it had arisen. We project our human minds into the cell and organ, and by mutilation and experiment we endeavour to induce it to take unnatural ways; we overlook the fact that these cells and organs were the most fully developed types of life when they were first formed. It is only to man that they seem to have become subordinate. Therefore, human interpretations are liable to be false or to make false explanations of primitive environment and development. X-rays, and electrical and chemical treatment, may induce changes in a tortured zygote or embryo; but such treatments did not exist in nature when these developed.

In all experiments inducing abnormalities, the Intelligence of whatever is being experimented on—cell, nerve, muscle, tendon, organ—makes a determined endeavour to adjust itself to the new and drastic changes in order to maintain its own organized existence and hence the existence of the complete organism. It is false science to draw conclusions concerning normal development from the abnormal products of the experimenter. Knowledge of how cell, tissue, and bone adjust themselves to new or exceptional conditions is interesting and useful, and is an aid in the treatment of accidents and diseases, but it affords no information about the origin and normal development of the organic whole. One can graft tissue, or even an organ, from one individual on to another and can make a monster with two similar organs in the place of one, but until the experimenter can make an entirely new organ with a new function as an integral part of an existing organism, until he can create an entirely new being with organs and functions and which can adapt itself to its surroundings, live an independent life, and produce similar adaptive beings, he is not justified in concluding that organic development takes place by chemical and physical action only, without any sort of guidance or Intelligence. And even then the conclusion would be false, because it would be Intelligence—the human Intelligence of the experimenter—that produced the new organ or being.

If adaptation of form and structure came from without, as the beating out of a horseshoe by means of hammer and anvil, we could perhaps reasonably argue that physics and chemistry had produced the organism under the influence of such external power; but as all adaptation comes from within, there must be an inner means of controlling, guiding, and adjusting the adaptations to environment which enable the organism to survive. The physics and chemistry of the organism are also controlled; they are the servants and not the creator of organic development. The Intelligence in atom and molecule combines to form a structure which adjusts itself to the contactings and impacts of its environment so as to maintain its existence for a certain time, and no matter how complicated the structure, this principle holds good throughout all nature.

It is unnecessary to describe the growing embryo further; it will be found in many books and is not essential for our purpose, and this book will be long enough without packing it with details much better dealt with elsewhere. It is enough to mention the special factors bearing on our theme, and this we will proceed to do. But the reference to the development of the thymus will show how difficult it is for the scientist to account for all embryological development.

VII

The zygote transfers its intricate and enormous powers to its daughter cells without any knowledge of what is going to happen after its first division. The changes, the differentiations, in the dividing cells are made blindly and without any knowledge of what is eventually to happen to them individually or collectively. They obey only the prophetic powers which the zygote has unknowingly bestowed on them. The cells into which they change cannot have any influence on their changing, nor, according to accepted biological theory, do these changes have any influence on the gametes which will eventually be formed in this process of change. True, the germ layer which is formed in due process of development of the soma has a very powerful effect on the organs and actions of the soma, but although this means that the germ-producing layer is in very close connection—nervous, glandular, electrical, or whatever it may be—with the organs and cells of the soma, it is asserted to be only one-way traffic; the germ-layer can affect the soma very drastically, but the soma cannot in any way whatever have any effect or influence on the germ-layer or the gametes it produces.

Why is this? We cannot tell you. We must refer you to the biologists, embryologists, cytologists, geneticists, fruitfliologists, biochemists, biophysicists, neurologists—they will tell you exactly all about it. We ourselves go to them for this act of faith, which we gratefully accept because it clears the way for our thesis—that Intelligence controls all organic development, and hence organic evolution.

Now, what compels a group of cells to take up a certain position in the developing organism and to stay there and divide in such a manner that it helps to build up the most complex organism in the universe and yet to lose the power, which the first daughter cells possessed, of reproducing cells similar to those from which the group is derived? Consider organic activity from the point of view of the materialist or determinist. There are two possible methods: one is that chemical and physical changes take place in the gametes, which cause changes in the mature organism, and if these changes enable the organism to survive they are preserved, but if not it dies, eliminated by Natural Selection; the other is that in the history of development certain changes emerge in the mature organism, and these enable it to adapt itself to its environment.

It is understood that in these methods the changes in the cell and subsequent development of the soma are not guided, controlled, or planned in any way and there is no power, no intelligence, at work in connection with them. Here is a cell with its contents, and by chance the chemicals passing into the cell are placed in certain positions without any special intention. The cell is just a microscopic unit of living substance which grows by absorbing chemicals and then divides by physical laws into two, and these again divide, and their daughter cells divide, and so on during many cell generations until the mature organism is complete.

Now, any change in the chemical constitution of the cell must consist of a rearrangement of the chemicals within it. In the germ-cell, the gamete, this may take place before it joins another gamete to form the zygote, or it may take place as a result of the joining together of the two gametes which form the zygote owing to slight differences in the gametes.

In the gamete this means that it has been constantly changing without guidance or purpose or intelligence ever since it became a gamete. It unites with another gamete which has also changed in a similar but slightly altered manner. (If too much altered the gametes either will not unite, or if they do they will produce a monstrosity which will not survive.) The result is a zygote which may accelerate an old, or cause a new, chemical change in subsequent cells because of the slight gametic differences. This zygote divides into two cells and these into four cells presumably exactly alike, but inasmuch as the third division, resulting in eight cells, has a definite differentiation, the second division cannot have produced four cells exactly alike, because in this event there must have been some influence external to the cells to cause the difference between the second division into four cells and the third division into eight cells, and this external interference is not acknowledged by any biologist (see page 259). This applies also to the first and second divisions.

VIII

The subsequent development of the organism into muscle, bone, organ, blood, nerve, brain, senses, organized structure, if not emergent, is all due to changes in growth and structure of cells produced from the zygote, and the source of these changes must be in the zygote unless some external influence has stepped in to make these changes. This, again, no biologist will acknowledge.

Thus the organization of the zygote is of such a nature that it contains all that is necessary for the production of the human body. But the gametes of mankind were derived from more primitive animals, and theirs were derived from still more primitive animals, and theirs from amphibians, and theirs from fishes, and so on to that early gamete which arises in the protist. This being so, what sort of change in chemical organization and structure can have taken place in the primitive germ-cell to have resulted in organisms so far apart as a worm and a man? There is no purpose, no guidance, no plan (for plan implies Intelligence)—only chemical absorption and change. Thus the germ-cell of man cannot be in any way different from that of the worm except in its organization, the special arrangement of its chemical structure. Any change in this must have resulted in a changed soma which is subject to the influence of Natural Selection. Those which survive will have this changed germ-cell.

These changes take place entirely by chance. A chemical compound is absorbed and placed in this position or that, the soma is formed, and, if the chemical has been put in the wrong place, the soma does not survive long enough to produce germ-cells, so this changed organism is eliminated, Natural Selection, which destroys the soma, having also destroyed the germ-cell within it which produced the wrong kind of soma.

The environment cannot compel the gametes to change; nor has it any power whatever to destroy them. The change must come from within the cell. It cannot be any urge in a definite direction, because the gamete is not amenable to urges, which postulate external interference. All that can be assumed—and it is pure assumption—is that the cell alters its own genic chemical structure for some unknown reason or due to some unknown cause, and the result of this alteration becomes manifest in the soma. The alteration so far as the gamete is concerned is not with the object of surviving, because the cell is actually surviving when it produces the changes and it cannot see into its own future. The changes do not destroy the gamete itself; they only make the soma more or less fitted to survive long enough to produce the next generation of gametes. If the soma does not survive, that certainly destroys the gamete which produced the unfit soma, and therefore other gametes which produced better somas would still survive; but the gamete knows nothing of this.

Thus the gamete has no knowledge or understanding of nature and environment. It does not fit an organism for an environment; it only places the chemicals of which it is composed into slightly different positions in the genes. It has no knowledge that by doing so the subsequent soma will survive long enough to produce cells similar to itself, which include these slight changes; it has no knowledge that in consequence of these alterations in the dispositions of its chemical structure an elephant will grow a trunk, a man will become dishonest, a fly will lay its eggs in the body of a living caterpillar. It knows nothing of the universe outside itself except that it responds to the chemical attraction of another cell, another gamete, with which it coalesces.

Does the gamete place these chemicals in slightly different places in the gene by chance—by pure chance? That is obviously impossible, because this would mean chaos in the cell. What, then, prompts the chemicals to change their places? Is it an urge? What form does an urge take in a gene—where is it in the gene? Is it local irritability? What is irritability in a gene and how can it induce the chemicals to go to different places without it becoming completely disorganized? Is it some special kind of affinity in the chemicals? What *additional* affinity is there in a gene that draws these particular chemicals together in such special places as to produce a quent cized, yet changed, complex soma? And how can zygote di change in the gene alter the changes *in position* nably exact cells whereby the *form* of the organism change resulting in uld do would be to transmit the chemical change second div sequent cell division as an internal chemical gen ike, because not *as a change in position of the complete cel* ce external t rminers, evocators, organizers of the embryolo cond division erate at this stage of embryonic development t cells, and t later.

(To avoid confusion in by any biolog the relationship between the gametes, zygo and second only the chemical changes in the genes con the gametes and the possible effects of these on VIII a have been considered. But it is highly probable that the changes in the position of the cells referred to above do not arise in the gamete, but in the fusion of gametes and association of genes in the formation of the zygote. No two individuals are exactly alike, and their differences reflect the differences which originate in the zygote from which they are derived and which the zygote passes on to the subsequent gametes through the germ layer. The gametes produced by each individual would probably produce offspring exactly like the parent if they could develop parthenogenetically (see page 243), but the union of gametes from different individuals to form a zygote would almost invariably result in the subsequent individual differing more or less from its parents.)

The scientist may perhaps be able to provide a complete answer to these questions sooner or later without calling on any other cause than Natural Law. But we already find a clear and sufficient answer in the internal Intelligence of the organism, which has developed just as the organism has developed, but always sufficiently in advance of it to bring about a general condition which will enable the type to survive. In many cases the organism itself does not survive, for of all the zygotes produced, only very few reach maturity, because the general environment is too antagonistic for certain individuals, and these are eliminated by weakness or by accident.

IX

The chemical and physical changes in the gamete or zygote result in the soma varying from the type. The test of the value of a variation is non-extinction. There are three kinds of variations: useful—those which help the individual to survive; harmless—those which do not help the individual to survive but which do not prevent its survival; harmful—those which prevent survival.

Variations originating by the impact of the environment, called acquired characters, are almost always helpful, because they are attempts to secure the continued existence of the individual by adapting it to its surroundings. These are stated to be non-inheritable in spite of their great value to both individual and race.

Variations originating from within are entirely independent of the soma or the environment; they occur by pure chance in the gamete or in the zygote, or are due to differences between the gametes which unite to form the zygote. In "amphimixis," as the union of the gametes is sometimes called, differences between the gametes may cause the soma to vary, but these are not new variations; they are previous ones modified in the endeavour of each gamete to prevail over its mate in some particular character. New variations of the three kinds mentioned should be approximately of equal occurrence. Harmful ones may destroy the organism immediately—that is, the zygote would have no power to divide;

or they may result in the death of the organism before, or at, birth, or before the soma attains maturity. Useful variations may be helpful to the embryo or to the soma at any time up to the end of gamete production in the body—after that they are not racially useful but harmless. Harmless variations may occur at any time between the formation of the gametes to the final dissolution of the body. A useful variation may enable the individual to live a long time after the gamete-producing stage has ceased—a good constitution may enable a woman to live for fifty years after the change of life—but life ends racially when the production of gametes ceases.

If these three kinds of adaptations occur purely by chance, there should be many more useful and harmless variations observed than harmful ones—obviously, because the individuals possessing the latter are usually killed off quickly. There should also be about equal numbers of useful and harmless ones—but where are all the harmless variations? The gametes or the zygote are always producing mutations, and the harmful ones die; therefore great quantities of harmless ones of most unique pattern should appear all over the bodies of all plants and animals, because the useful ones would retain their characters and places with little alteration, while harmless ones would be free to grow in any shape or form and in any place. A few harmless—or seemingly harmless—variations may be observed, but compared with the useful ones the number is negligible; yet they should be legion.

Variations consist of changes in the organism, and if they become permanent the organism differs from the type by the extent to which it departs from the normal—that is, they are variations which breed true. When variations are so widely different from the type, or from other varieties, that they will not breed with them, this is called a specific difference, and the bearers of it become a different species of the same genus. Naturalists will not agree altogether with this definition of a species, because many types show great differences in detail sufficient to be called a species, though they will breed together, but failure to breed is the principal factor in species-making, and it is enough for our purpose here.

The individual is ever trying to adjust itself to its environment. If the powers it was born with are not enough, it does not wilt and die, it makes strenuous efforts to change and keep alive; instance the flying fish, the leaping gibbon, the crawling dodder, the neck-stretching giraffe, the hunting tiger, the escaping deer, the timid stentor, the shrinking vorticella, and others too numerous to mention. These efforts do not come from the zygote; it knows nothing of them; they are efforts of the mature organism itself made by the urge within it. It is generally accepted that the results of these efforts—these characters acquired during life—are never transmitted to the gamete of the organism making them, and therefore they are racially useless. If so, then they can be nothing but individual organic effort or drive, and as they are directed with a special object—to survive—they must be due to some sort of inherent power distinct from the gamete. It must be the Intelligence of the individual organism controlling some necessary action in order to maintain the existence of the organism. The chemicals in the organism could never of their own accord compel it to make the changes frequently necessary for individual survival; yet only those which are able to make these somatic changes do survive. They leave offspring, but these do not possess the powers which enabled their parent to survive—they are still but the average of the race; the effort is therefore not provided by the zygote or the chemicals; some somatic source must be found for it. The individual makes a unified objective effort due to its own inherent Intelligence, and whether this effort is transmitted to the gamete or not does not concern us —it is enough that it shows Intelligence in action.

It is generally assumed that the characters mentioned above—flying, leaping, crawling, etc.—originate in mutations in the gamete or the zygote. Darwin puts them down to the accumulation of small variations. In either case, the characters arise in the zygote and not by the transmission of an effort made by the adult organism. If this be so, the organism would never make an effort because it has none to make; its survival is due to its altered characters and if these fail, it perishes. But it is obvious to everyone that all organisms on occasion strive to the limits of their physical powers to achieve abnormal ends and frequently survive by doing so: from which it must be concluded that such efforts are mutations of unknown extent latent in every individual awaiting some accident of the environment to call them forth. Such a conclusion is nonsense and some other explanation must be found for these efforts.

Use is necessary for the continued existence of any organ or part of the body. When an organ ceases to be of full use it degenerates. But it does not disappear at once, it does not mutate out, nor does it suddenly cease to be of use; it degenerates gradually, or it gradually becomes harmful and may cause the whole organism to disappear. Sometimes a part appears to be useless, yet it continues to be produced generation after generation; such parts may have some use which is not obvious or they may be so innocuous that they just continue to carry on, though this is contrary to the principle that a useless part disappears owing to the economy of the organism depriving it of nourishment. Hair on the human body persists, though of little use; the legs and feet of the whale and of the slow-worm persist in a very degenerate condition, though they seem to be gradually diminishing.

Elimination seems to be in direct relationship to harmfulness or uselessness or to the economy of the organism, the rate of elimination depending on these. The changes in the degenerating organ thus respond directly to the incidence of the environment in spite of assertions to the contrary. Such changes are assumed to be due to genic changes (see page 257), but how does the gene change in respect to degenerating organs or parts? Unless it knows what to do, how can it change in itself and hence cause the reduction of the part? If there is no transmission of degeneracy, it is impossible for the gene to understand what it has to do. What induces it to cease promoting the full vigour in a part which is degenerating while at the same time the soma survives and bears offspring? It has no connection whatever with the part, though it is responsible for its existence, and Natural Selection has not killed off the organism and *has no effect whatever* on degenerate parts. How, then, does the zygote or gene know when the full vigour is unnecessary—perhaps dangerous? A foolish question, for the zygote admittedly knows nothing of this, and all its mutations occur at random—by pure chance. But how comes the remarkable coincidence that chance mutations in connection with one particular part occur in exact ratio to the uselessness and degeneracy of that part? The deterioration is steady in one particular direction, and coincidence is strained to the borders of the miraculous if it is maintained that steady continuous changes in one direction occur purely by blind random mutations. The mutation of the genes which *originated* the character which has become useless was associated with the general organization of the soma—it was not one but thousands of genes that resulted in a leg or a neck or a wing—and therefore it must be the co-ordinated mutation of the genes, every gene mutating *at random*, which brings about the *reduction* of the same character when it degenerates; and yet, genically and racially, the character is perfect, inasmuch as the bearer of it survives, progresses, and procreates. If there is no connection between the soma and the gamete—that is, if any direct response of the individual to a change in the environment has no effect whatever on the germ-cells—then this gradual degeneration of parts is one of the greatest proofs of the Intelligence which is at work in the organism.

What does all this signify? Simply that if genes, hence gametes, mutate by pure chance, the long series of mutations in one direction is impossible to understand. If they are guided or controlled in any way whereby successive mutations occur, it must either be by the organism itself influencing the genes, which means the transmission of somatic variations—which is stated to be impossible—or by some intelligent power co-ordinating the mutations of the genes with the necessities of the organism from gene to adult. In any case, these long successions of mutation by degrees in one definite direction put an end to the random or chance theory of genic variation.

The gene theory implies that all genes are mutating constantly, in which case the organism should bristle with variations, large or small, in every generation, all these mutations being transmitted to the next generation unless the organism fails to reach maturity. That genes do mutate freely is shown by the number of varieties occurring in horticultural plants which are grown under artificial conditions and preserved by artificial selection. But there is little evidence of normal mass mutations occurring in nature, as necessitated by the gene theory.

X

The chromosomes are said to be the bearers of heredity (the hereditary characters being found in the genes) and are well-defined masses of genes in a protoplasmic matrix (see Fig. 11, page 252). These genes, incidentally, are purely imaginary groups of colloids, being far too small to be seen by the highest power of the microscope. As in the case of atoms, they are assumed to exist because certain phenomena necessitate the assumption of exceedingly minute sources of origin and it is thought that genes may consist of single large organic molecules.

Much experimenting has been done on chromosomes since

1900, and the discovery about that time of Mendel's experiments on peas and flowers, made about 1860, with his interpretation of the results, formed a distinct epoch in genetics. He discovered that similar characters differing in some detail—characters such as height, colour, smoothness—when brought together by crossing the individuals bearing them, did not produce offspring showing an average intermediate condition, but that only one condition appeared, the other being suppressed or disappearing altogether. Tall and short peas when bred together produced only tall peas; smooth and wrinkled pea seeds produced only smooth ones; purple and white flowers produced purple flowers only. But Mendel was not satisfied with this result; he bred together the seeds from this first generation, taking care to prevent any other crossing, and the next—the second—generation produced seventy-five per cent. of forms similar to those of one original parent and twenty-five per cent. similar to the other original parent—seventy-five per cent. tall peas, twenty-five per cent. short; seventy-five per cent. smooth pea seeds, twenty-five per cent. wrinkled; seventy-five per cent. purple flowers, twenty-five per cent. white. This result induced him to continue the experiments still further, because it was evident that the character suppressed in the first generation had not disappeared, but was only latent.

Incidentally, the method of controlling the crossing of plants is as follows: The individual flowers are enclosed in muslin covers to prevent insects visiting them. The stamens of purple flowers are removed so that the pollen from them cannot fall on to the stigma of the same flower, and pollen from a white flower is taken from its stamens by a camel-hair brush and placed on the stigma of the purple flowers. This operation is repeated the reverse way, pollen from purple flowers being placed on the stigmas of white flowers. The same operations are made with plants having smooth or wrinkled seeds, or tall or short habit. The resulting seeds from every plant are gathered, counted, and those from each plant are kept separate from the others; they are sown and the plants arising from them are observed and the results noted. In the plants from the first generation—those from the *cross-bred* plants—the results were as given above, all showing the character of one parent only. The seeds from this generation were sown, but the plants arising from them showed both the original characters in the proportion of three purple to one white. The plants from this generation were *inbred* by pollinating purple with purple and white with

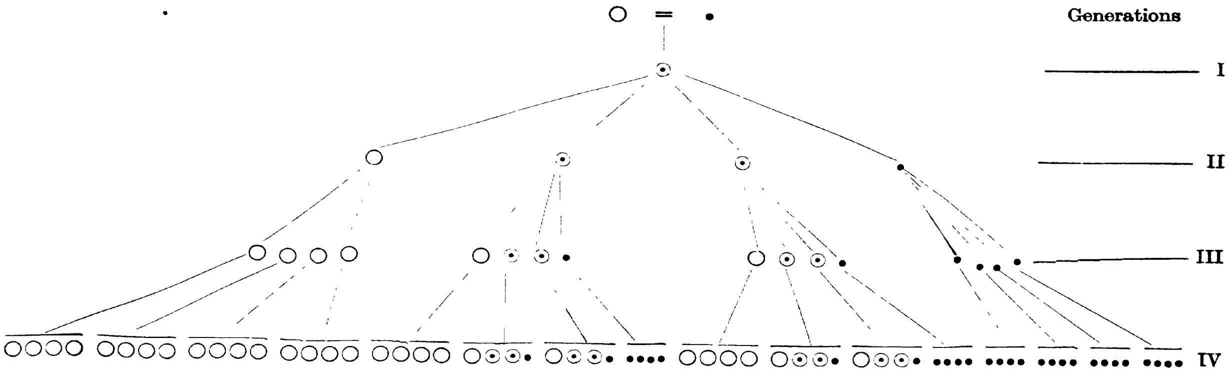


DIAGRAM OF FOUR GENERATIONS FROM THE CROSS BETWEEN ○ AND • TYPES.

Gen. I. All offspring appear to be of the ○ type. These are then inbred.
,, II. Three-quarters are of the ○ type and one quarter of the • type. These are again inbred.
,, III. These produce ○ and • types in the proportion of ten to two from the ○ types, and the • type produces • only.
,, IV. All • types again produce • only. The ○ types produce thirty-six ○ types and four • types. In all, twenty-six • types and thirty-six ○ types are produced. The difference between them is eight, and if these are considered to be hybrids and the diagram examined, it becomes evident that there are equal numbers of pure ○ and • types in this generation, and in the II generation there are twenty-five per cent. pure ○ and twenty-five per cent. pure • with fifty per cent. hybrids. With each generation the hybrids become proportionally less compared with pure types.

Note : The ○ type in peas may be tall, or smooth seeded, or purple.
The • type in peas may be short, or wrinkled seeded, or white.
The ⊙ is really a hybrid but shows only the ○ type.

white; tall with tall and short with short; wrinkled with wrinkled and smooth with smooth. The following generation was the most remarkable of all and gave Mendel the clue to what was happening; the purple-flowered plants gave purple and white in the ratio of three to one as before, but the white-flowered plants gave white only. The same occurred with other characters. Further inbreeding resulted in this proportion occurring regularly, and it became obvious that the flowers which had the character suppressed in the first generation always bred true when this character reappeared. It became apparent also that as twenty-five per cent. of the offspring of purple flowers were always white and these bred true, probably twenty-five per cent. of them were true-breeding purple, the remaining fifty per cent. being actually hybrids but with the opposite character suppressed. The observation of further generations proved this to be true. See diagram on page 273.

It was evident that the characters existed in a pure form somewhere in the gametes, and, as the chromosomes are the bearers of heredity, it must be in these. But, as one organism has many characters and a limited number of chromosomes, it was suggested that the latter contained minute particles which were called " genes " and which were responsible for these unit characters. These are the genes we have been discussing. Upon this basis the science of genetics has been built up, and thousands of remarkable and very interesting and informative experiments have been made. Also many conclusions have been arrived at and many suggestions made to account for the results obtained. These we must examine a little, because they are directly concerned with life and evolution.

The chromosomes are always constant in each species, though in different genera and species their numbers bear no relation to their position in evolution. There is also stated to be a " fundamental stability " in the chromosomes, and their method of separation during cell division is constant. They vary considerably in number in different species of animals and plants. In the worm Ascaris there are only two; in the crayfish there are 200, from which it would seem that number is of little importance. Organisms as widely apart as iris, tobacco plant, snail, moth, man, have all forty-eight chromosomes each. In flowering plants they may be anything from three to forty-five, mostly eight to twelve. In one genus of plants—the docks and sorrels—there are from ten to 200 chromosomes in different species.

When the somatic cells following the division of the zygote grow and divide, the contained chromosomes and genes must also grow and divide. The cytoplasm assimilates the chemicals passed into the cell through the cell membrane and builds them up into colloids similar in chemical constitution and physical form to those of the genes in the cell, each gene differing in its constitution; otherwise it could not exercise its special control in the soma. The genes fuse with their appropriate incoming colloids, thus growing in size, this larger bulk being possessed of the same powers as the gene, and dividing with the dividing chromosome, which means that the gene imbues the " non-living " colloid with its own organic " life." Actually, both gene and colloid are " living."

We have several times referred to the importance of memory, and here we may ask whether or not the gene is aware of the result of its action. If it is, this is memory—a memory which is hereditary. If it is not, then at every cell division the genes of every part would not know what to do next. All would be chance. But when an embryo begins to develop there is no doubt whatever about the result, and chance is absent, memory accompanying development all the way. Memory is the anticipation of events by Intelligence, which knows what it is doing and what immediate result is to be attained. The following remark by an eminent cytologist is an eloquent testimony to the suggestion that Intelligence always precedes action : " It is therefore clearer in the chromosomes than in any other structures that the hereditary properties always arise in advance of the uses to which they are put."

It seems, then, that the germ layer, the gametes, the zygote, the embryo, the adult soma, form one unified scheme, being all connected with each other and all dependent on each other in the life-cycle. Guidance and control by Intelligence would account for the production of variations and the development of a character along a definite line when that character proved its value. If Intelligence is accepted as an agency whereby new varieties and species are produced, the inheritance of acquired characters is unnecessary. But Intelligence would not produce characters at haphazard, it would rarely mutate. It is the wisest influence in the world and would change the organism only when necessary for it to survive in any particular environment, or to achieve greater harmony with its environment where this could be done without prejudicing its survival. It would control both gamete and soma, and would constantly adjust the organism to all sorts of trifling changes and nuances in its surroundings, both internal and external, with as little waste and as little effort as possible, and all the wonderful adaptations of plants and animals to their surroundings are thus easily accounted for. These changes originate in the genes, and there must have been an evolution of these from the primitive protoplasm in keeping with the bodies, from amœba to man, which the cell has produced, while the power of dividing and growing has enabled organic life to develop from the single cell to the stupendous forms that occur and have occurred during the last two hundred million years—dinosaur, mammoth, whale—and the smaller but far more interesting primates from Spectral Tarsius to man.

XI

When the embryo has developed to the stage when it can exist apart from the mother, the great adventure of life begins. The fully organized individual is launched on the seas of environment, and must soon depend on its own exertions for its survival in the struggle for existence. This phase concerns us vitally as human beings, but the details fill all the books of the world from one aspect or another; for our purpose we can deal only with those which illustrate the development and action of Intelligence.

The care of offspring by the parents which began with some of the fishes becomes highly important with the mammalia. Glands are developed for suckling the young, and in many species the young are guarded for some time after weaning. This guardianship is longest in man, due probably to the complexity of the brain and the nervous system, which do not become fully mature until long after birth. Its interest to us is that a communal phase of life—the family—is introduced, which binds individuals together after the biological necessity of guardianship has ceased. This seems to be hereditary, but how far emotion and custom also bear upon it is debatable. Many animals cease to be interested in their young very soon after weaning, but it is understandable that the break between them is unlikely to be sudden because of their close association up to that time. Much depends on how far the offspring learn to fend for themselves during the later stages of weaning.

A new emotion seems to have arisen in humanity in connection with the retention of the link between parent and child. Love and respect are usual to the end of life, and these cannot be credited to the zygote, because they have no individual survival value. Whatever value they have is due to themselves—that is, love and respect result in family associations which are not formed for the purpose of seeking personal advantage but which do actually have that effect. It seems more like the effect of a rational Intelligence rather than the survival of the fittest in the struggle for existence, and this family association is the basis of all human affairs from the most intimate details of life to the most intricate problems of the State.

Biologically, the individual comes into conflict with its environment very soon after it emerges from the egg or very soon after it is weaned—especially so in wild nature. It already possesses the means of obtaining food, and it must now set out to seek it, while at the same time avoiding or resisting other animals who would deprive it of its food and who might possibly eye the individual itself as something good to eat. It has adaptations for special foods or for special means of escape—adaptations which are parts of its inheritance or which it makes for itself during life.

These adaptations are so varied and so numerous that they have resulted in many widely different forms of life developing from basic differentiating types. In the mammalia there are mouse, man, elephant, dog, bear, tiger, rabbit, rhinoceros, deer, whale, and hosts of others; in birds there are humming-bird, ostrich, eagle, peacock, wren, dodo, moa; of fishes and crustaceans there are many thousands; of insects, hundreds of thousands. It is around adaptations due to the organic form or character varying from the parent form that the great controversies about life and creation have arisen, and about which theories of evolution and heredity have been formulated.

As no hereditary influence passes from the soma to the gamete, the child inherits nothing from its parents, and never did. The likenesses between parents and children are due to similar chemical and physical conditions in the gametes which formed the parents and those which form the child. A child cannot inherit its father's nose or its mother's charm—both nose and charm originate in the gametes or the zygote which form father and mother, and if by chance they come together in the zygote which forms the child they may both appear when it reaches maturity. But no effort on the part of the parents to make the child follow in their footsteps, or to make the child better than themselves, will ever have the slightest effect on their grandchildren, though it may probably have a superficial effect on the child; even so, it cannot alter the " nature " of the child, it can only bring out its latent characters.

All heredity, then, passes from the zygote through several specially allocated cell divisions *in the soma* to the germ-layer which produces the gametes, while all other cell divisions produce the soma which exhibits the likenesses between parents and children which we call heritage. It is not heritage at all; it is merely likeness. The cycle—gamete–zygote–soma–gamete—would account entirely for heredity and for all the characters in both soma and gamete, but according to geneticists this is a cycle that never occurs, the only possible hereditary cycle being gamete–zygote–germ-layer–gamete. The germ-layer cycle is potentially immortal; the somatic cycle invariably ends in death. Yet without the somatic cycle the germ-layer cycle could not exist. The somatic cycle is the one which is of most importance to the organism, because it is this which has an independent existence in relation to the external environment and which exhibits the commonly observed phenomena of life. The link between the two cycles, and the controller of both, is Intelligence.

As species are almost always progressive—that is, more complex or more highly developed than the types from which they spring—there are progressive changes going on in almost all forms of life. This is evolution. In some organisms the change is retrogressive; this is a return not to an earlier form but to a simpler form than that of its progenitors, and may in fact be evolutionary, not atavistic. The hermit-crab, sea-cucumber, fungi, are such retrogressive forms. Some forms are so constant that they are very similar to those existing millions of years ago; lung-fish, pike, skate, Latimeria, platypus, tuatara, king-crab, cockle, the water-plant Isoetes, the common weed Horsetail, the " four-footed " bird hoactzin, are such forms. (Latimeria was known as a fossil which existed from 300,000,000 to 50,000,000 years ago, after which it was assumed to be extinct. It was recently discovered alive, being captured off the south-east coast of Africa.)

Evolution is the result of a change in the form of the organism which fits it for survival when in conflict with the environment or with other organic forms, or when it adopts better ways of obtaining food or producing offspring. If it does not change, it is in danger of extinction, and it is such extinction, as apart from accident, which Charles Darwin termed Natural Selection, the implication being that nature selects this particular animal or plant to disappear.

Survival is the continued existence of the body until it attains the gamete-forming stage. Any natural event which destroys the body before that stage is reached results in the elimination of the line of life so far as that individual is concerned. This is the test of whether a variation is harmful, but not whether it is harmless.

An accumulation of effects is not evolution; nor is a consecutive series of events evolution. Evolution demands a permanent change in the organism, biological or social, which is irreversible. If the conditions to which the organism adjusts itself are removed, the organism dies because it has gone too far to return to its original condition. If the conditions change, the organism must change or die; this is essential for evolution. New conditions can never be replaced by original conditions, because conditions themselves evolve. We have climbed up the ladder of ourselves and the rungs are broken beneath us. Evolution, therefore, means a necessary, definite, permanent, progressive change.

For progress, for evolution, it is essential to have a plastic organism and a changing environment. The reaction of the organism to its environment means greater fitness to survive, and this spells progress. Even in degenerate organisms this is true, because the alternative to change is extinction, and existence must be considered preferable to non-existence even in degeneracy, when the degeneracy is a natural development and not a physical or mental disease.

XII

Now, every living being, every stone, every atom, is to itself the centre of the universe, and all the rest of the universe is its environment. Environment came into existence when the free will of the particles turned them into mitrons; when Intelligence first took form as moving particles.

What is environment? It is everything that exists from mitron to the highest forms of living organisms, and includes nebulæ, suns, planets, bacteria, vegetable and animal life, the organs of our bodies, the beating of the heart, the motions we make, the thoughts we think, our desires, emotions, passions, the books we read, the scenery we enjoy, *our travels and adventures, our loves and our children, our* joys and sorrows. Everything! And, above all, our memories. If the environment ceased to change, the organism would also cease to change, but environment is so complex that such a possibility is beyond discussion.

The environment is the actual determiner of survival, Natural Selection being but the term used to signify the abstract "cause" of survival. Only one out of several variations is sufficiently well adapted to maintain its existence, and when the others are eliminated it is stated that Natural Selection is the cause of this. But that which created or formed the several variations is more important than that which destroys the unfit ones. If no varieties were produced, Natural Selection would have no reason for existence, so it depends on varieties, just as space and time depend on the existence of mitrons. Space, time, Natural Selection, gravity, life, and many other notions are not entities, they are conditions contingent on matter and its development, having no independent existence of their own. They have no personality; they cannot actually do or perform or influence anything; they are names for what happens—not forces or causes that make or compel things to happen. Thus, Natural Selection does not select the fit—it is simply a term indicating that if organisms do not survive to maturity they die, for some reason which Natural Selection knows nothing about. It does not preserve anything; it does not select anything. In the organism, eternal vigilance is the price of survival, and Natural Selection is but the name for the lapse of that vigilance. But, like space and time, it is a very convenient term if we appreciate its exact meaning, for it expresses the most powerful relationship in existence between varieties and the environment which slays them or in which they survive.

Man, by his researches, inventions, and social organizations, can so alter his environment that he can evade the rigorous effects of Natural Selection. He can produce new forms of plants and animals that would never arise in nature—forms which he has made to suit his own convenience; nearly all domestic animals and plants are such forms. He has also created an unnatural environment of disease, war, famine, misery, distrust, hatred, hypocrisy, superstition, aggressiveness, brutality, cruelty, with which Intelligence is quietly, patiently, constantly striving, but man for whom it is striving may even now be drawing towards his tragic close. Intelligence is residual in all forms of matter, and when man produces a new species he is not creating Intelligence, but is unconsciously manipulating that which is in the organism on which he is experimenting. So if ever he desires to create an environment of peace, prosperity, health, love, honour, goodwill, harmony—all of which are even now well within his reach—he must co-operate with the Intelligence he possesses, or all his efforts will be in vain. He must not be content to put these things in the forefront of his prayers and expect them to be granted to him; he must depend on himself and on that Intelligence which is always urging him to do what is best for his own welfare, or he will never attain these things. But man, the lunatic, seems determined to assassinate man, the intelligent —not by the craziness of all men but by the criminal stupidity or savagery of the very few. With men as a whole, the fault lies in allowing themselves to be driven to the destruction of mind and body by the tyranny of those in authority who think far more of their own power and position than of the welfare of the people who have put their trust in them. But this is only temporary, and we are apt to give greater importance to the times in which we are living than to the long millennia during which life has climbed up from the cell to ourselves—the only point is that we could speed up progress towards harmony so vastly if we would orientate ourselves towards our own Intelligence.

It may be said that the evolutionary principle is not true; or, if true, that it is not the only principle of development in the universe—that other principles exist which are as good as, or better than, evolution to account for the multifarious forms of life on the earth. There is no harm in thinking so providing that it does not interfere with, condemn, or prohibit other principles or ways of thinking. But so long as the evidence for evolution is stronger than the evidence for other methods, and is apparently the best way of accounting for the existence of the universe and the organisms in it, it is a waste of thought, endeavour, and life to put trust in principles which will not bear critical examination and which are only imaginary fancies of men's minds—usually men who refuse to examine or consider or accept the evidence of their senses and their experiences. For in the search for truth the reasonable interpretation of facts is of immeasurably greater value than any irrational interpretation of the same facts.

Listen to the words of a great experimental embryologist: "Terms have been used which point not to physical but to psychical analogies. This expresses my conviction that the suitable reaction of a germ fragment, endowed with the most diverse potencies, in an embryonic 'field,' its behaviour in a definite situation, is not a common chemical reaction, but these processes of development, like all vital processes, are comparable, in the way they are connected, to nothing we know in such a degree as to those vital processes of which we have the most intimate knowledge—viz., the psychical ones.

"It expresses my opinion that, even laying aside all philosophical conclusions, we ought not to miss the chance given to us by our position between the two worlds. Here and there this intuition is dawning at present. On the way to the high new goal I hope to have made a few steps with these experiments." Herein we have another interpretation —but we seek Truth in a goodly company.

CHAPTER XX

BRAIN AND THOUGHT

I

THE assessment of universal values is apt to be misleading. The amazing wonder of the stars, planets, nebulæ, the Milky Way, is so overwhelming that our little bodies and minds, and all our petty trials, troubles, and every-day difficulties, our successes, our loves and joys, seem trifling in comparison. This is entirely wrong. The brain of man is incomparably more amazing and wonderful than all the orbs of heaven put together. The stars and nebulæ are but the rudimentary and primitive forms of existence; it is not these and the high heavens that are the greatest phenomena in the universe, but the brain, the nervous system, organic being, and the thoughts, emotions, and consciousness of man. Nebulæ, stars, planets, organic beings, man, are all derived from the same source; they all go back to primitive motive substance with its spatial, temporal, electric, magnetic, mnemic, elastic qualities. Through contactings, linkages, attractions, the pre-atoms, electrons, and protons have emerged, and from them the chemicals which collect into vast groups, straining the matrix of particles which constitute the background of the void, forming suns and eventually planets whereon the further development of inorganic and organic matter results in the evolution of plant and animal, and, eventually, man. Thus, the nebulæ, suns, and planets are but very primitive stages in man's development.

When the relative differences between man and molecule are considered, and the complex organization of man, with his emotions, passions, thoughts, consciousness, are compared with the simplicity and apparently mechanical constitution and conduct of the molecule, it seems incredible that one could be derived from the other; there must be something far greater in man than in molecule, some different quality, something noble, more majestic, more divine. But if he is noble and divine these intimate parts of him must partake of his nobility and divinity, for non-intelligent mechanics, physics, chemistry have produced an Intelligence beyond anything in the universe to understand—beyond physics and chemistry, even beyond imagination. If we pause again to dwell on the most certain fact of human existence—the fact that every man now living and every man who has ever lived has passed through the stage of a microscopic cell—we are compelled to acknowledge not only the possibility but the certainty of man's origin from the molecule, and if from the molecule, then from the atom, and so from the mitron—or whatever it is. When we get the full measure of the relationship of the individual man to the universe we shall be able to put true values on each phase of his development as an individual—from cell to senility, as a member of society, as the end product to date of a process beginning with the first movement of Intelligence. But at present we shrink before the simple immensities of the high heavens and take for granted the incomprehensible miracles of thought and action in mankind.

As the body has increased in complexity, so has the brain, and as the brain must co-ordinate all the complex activities of the organism, it has developed to a much greater extent, comparatively, than the complexity of the body. That is to say, something beyond the essential needs of organic activity has developed, and this organ, the brain, is thus capable of more than merely controlling the operation of the organs of the body—it introduces the co-ordination of all organic activities. For this purpose it has properties, functions, or qualities not inherent in any of the other organs either individually or collectively. These functions may become active in other directions than controlling the body, and so thought arises, and art, music, invention, philosophy, develop.

It has been mentioned that nerve-cells, once formed in the embryo, never divide to produce others—which means that when destroyed they can never be replaced. The reason is that they are the seat of memory, and memory, being a change in the internal relationships of the individual cell organization, cannot be transferred from one cell to another. Division of the nerve-cell would be pointless in these circumstances; new cells, or cells produced from the division of mother cells, could not take over the impressions, the somatic memories, of the mother cells, even though they could respond to stimuli. This is also the reason why nerve-cells remain receptive and active to the end of life; if they aged as quickly as most other cells, men could never attain their present age or intelligence.

By disuse the brain would lose its spontaneity, and would remain static or would degenerate. In animals, Intelligence is suited to its needs in any particular environment; beyond that, Intelligence does not and perhaps cannot develop. There is no real need for it to do so, because it has reached harmony. Hence, when man attains perfect harmony in his existence, in himself together with his environment, his development will cease; but he will have attained heaven and life will be perfect. Such a consummation, however devoutly to be wished, is a practical impossibility, because the environment of mankind, mental as well as physical, constantly changes in relation to the constant changing of the earth and all that is in it. Intelligence as constantly adapts the human organism and its mentality to these changes, and all we can do is to endeavour to understand the efforts of Intelligence, and consciously to assist it to bring about this consummation. Such assistance is the only reward that most men will desire in the future.

II

The object of the senses is to get in touch with the environment. If this is not done, the organism remains in an immature state and does not attain its full mental stature—it is an idiot. Such an organism could not continue to exist under natural conditions. Even when the senses are in action they must in some cases learn how to operate accurately. The eyes of a newly-born child are quite unable to judge distances, and until it obtains experience by moving from place to place its eyes deceive it. It perceives movement, but cannot judge the distance of the moving object.

The senses are the means of gathering information for the use of the intelligence. This information is used both waking and sleeping, but is masked during waking hours by consciousness. All perceptions of phenomena must pass through the sieve of the senses before they can become impressed on the brain. There is no experience known to man which has not come through the medium of the senses either immediately or remotely. If a single experience could be clearly and unmistakably shown to be derived from or through any other source, there would be at once a case for external interference in connection with development and with the destiny of man. Even the "spirits" tell us nothing spiritual. "Seers" prove to be quite wrong about the things they profess to see beyond the experience of their senses.

The senses have evolved during the struggle for existence and are primarily for that end. Animals, down to very low ones, have senses similar to those possessed by mankind, and some senses are even more acute. Indeed, there may be among the lower animals senses different from those of man—in ants and lobsters, for instance—while in bats and dogs the sense of hearing, and in dogs the sense of smell, are much more acute.

Our senses are thus part of the environment of that Intelligence which controls us. There are three phases of environment: the internal, which is entirely within our bodies; the superficial, which is that part of us which contacts with the rest of the universe; and the external, which is outside us. The senses form part of the superficial environment. When the Intelligence which controls us ceases to operate, death ensues. The Intelligence dies away, as it is no longer needed, and lesser Intelligences—those pertaining to organic molecules, inorganic molecules and atoms—continue to operate during the gradual dissolution of the body.

Truth and reality must be put to the test of the senses before they can be accepted as such by the brain. Theories, hypotheses, opinions, suggestions, assertions, ideas—all are derived from phenomena through the medium of the senses and must ultimately be referred back to the senses for confirmation. Thought will array sensual receptions in new ways, new juxtapositions, which will provide new explanations, but unless these are confirmed by experience through the senses they are valueless. It was not until certain physical facts were observed that the theory of Relativity became accepted.

It may be asked: How could the incredibly primitive Intelligence of the proto-atom lead to the magnificent creative thought of man? In reply one asks: How could a single microscopic cell develop into a man with his marvellous organization, his organs, glands, muscles, senses, nerves, his remarkable brain, his will, thought, idealism? How could a vast orb like the sun be but the accumulation of atoms so small that they cannot be observed by the most powerful microscope? Or how could various ways of manipulating one and one and one result in the complicated and involved problems and theorems of higher mathematics? By comparison, the development of Intelligence presents no insuperable difficulty.

But these are not the most difficult questions that may be asked. What really seems impossible to understand is how the electron and the positron, neutron and neutrino, proton and quantum, came to exist; how the atoms were formed from them; how radiation occurs; how atoms combined to form molecules—one of the greatest of problems; how life arose from apparently non-living chemicals; how the whole of an organism is kept in co-ordination and its activities synchronized, and how it responds to stimuli and manufactures at the right time and in the right place the blood and secretions needed for the maintenance of the organism; how thought and consciousness arose, and thereafter self-consciousness. Even the most idealistic forms of thought are based primarily on sense stimuli. Seers and prophets all see and prophesy about impressions they have received through the senses. The hereafter is like our world; life in the hereafter is like our life; the inhabitants of other worlds are like ourselves—all with hypothetical advantages which eliminate the difficulties and troubles, often made by ourselves, of this world. Take away our world and of what would the hereafter consist? These are fundamental questions compared to which the difficulty of the rise and progress of Intelligence is easily understandable.

III

Intelligence does not think in words; it is more fundamental than language. But conscious thought, which is usually in spoken or unspoken words, is limited by the words it uses; nevertheless, problems presented to the brain in words largely form the basis of these ideas which are considered and, if possible, solved by Intelligence *without words, though they must be translated again into words before conscious thought can readily understand or* benefit by the solution. Language is part of the environment, and has no meaning apart from relating Intelligence to what is happening outside it; hence Intelligence, as thought, functions not in terms of language, but in terms of ideas, and language is only a help in the intercommunication of ideas between one person and another. If, as is sometimes stated, language is necessary to thought, then thought arises out of and is dependent on language. In this event we should be born with the rudiments of language in our minds, just as the rudiments of thought are in our minds; but this is not so, language being an acquisition which must be taught to us. If thought is not dependent on language it must be based on ideas arising out of the sensations presented to it through the senses. But the results of thought must be translated into language if they are to be communicated to others, and language may be called an auxiliary sense.

We are under the impression that we think in words because when thought dwells on any particular subject it operates selectively and words assist in clarifying the subject or object thought upon. In walking through the country one observes fields, trees, cows, sheep, birds, flowers, footpaths, bees; one hears the lowing of the cows, the barking of dogs, the singing of birds, the rippling of waters; one feels the warmth of the sun, the sting of the nettle, the breath of the wind. But all these are not crowded into the brain as words every time they are observed—they are vague general impressions, and only when for any reason we wish to concentrate on any special object, or to make comparisons, do the words associated with the objects concerned come automatically into our minds—and we think we are thinking in words only.

From the observed relationship between the senses, brain, and thought, it seems evident that the brain arose as a collecting ground and distributing apparatus of sensations—take away senses and sensations, and what becomes of the brain? These sensations are recorded more or less permanently in the brain as memory, ready to become associated with new sensations of a similar kind. Ideas arise out of rationally associated memories, and the flux of these ideas constitutes thought. The brain, as the organ of thought (take away the brain and what becomes of thought?), thus utilizes memory for the benefit of the organism. That thought seemingly transcends this operation does not justify the assertion that it transcends the brain.

We cannot stop thought; we have no control over its working. We can only direct it to the subjects we want to think about. What is it that selects these subjects? If we make no selection we still go on thinking, and thought rambles on without control. The sensory nerves do not think; they are the conveyors of messages to the neurons of the brain. Do the neurons think? Collectively it appears they do. One cell by itself cannot do much thinking; but in combination, the greater the number of cells the greater the capacity for thought, so that 9,280,000,000 cells provide plenty of scope for thought.

Thought begins with the first breath of the newly-born infant and ceases only when the last breath is drawn. Through sleep and other phases of unconsciousness it is always active. When it ceases, this is due to the organic associations between the neurons fading away, thereby stopping the reception of impulses from the senses and from the organs. These then show the signs of death, the organs losing their functions, blood ceasing to flow, resistance to bacteria breaking down, and there is a rapid general dissolution. It thus becomes evident, as stated, that thought cannot be controlled, it goes on in spite of us—it goes on always. We can guide it into certain channels, but we cannot stop it; if the guidance ceases the attention wanders, and we find ourselves thinking about simpler immediate interests—food, pleasure, memories. We are under the control of something other than the brain—namely, Intelligence. When we direct our thoughts, it is the effort of Intelligence that so directs them; when direction ceases, subconscious Intelligence carries on our wayward thoughts. Intelligence expresses itself by means of thought, and it is in consciously directed thought that reasoning appears.

IV

It is inconceivable that in an organism a brain should have developed to a certain point without thought or intelligence and at that point thought should have suddenly begun. Some philosophers are of opinion that Thought exists in the universe quite apart from the brain of man. This Thought becomes attached to the brain and dominates it. The brain of the lower animals is presumably incapable of receiving this sort of Thought, though at what point in evolution early man received it is not very clear. The nervous system, which comparative anatomy shows to have been developed gradually from primitive forms of life, is immediately controlled to the uttermost by this Thought, and when the brain ceases to function Thought leaves it, returning whence it came as it cannot go out of existence.

But where was this Thought before it entered the brain, and in what form did it exist? Was it in the atmosphere, or the ether, as a mass of universal homogeneous Thought ? If so, in what form did it exist in that medium ? How did part of it become detached and enter the human brain, and how was the remainder affected by this detachment ? Could it function perfectly after it had parted with enough of itself to supply the brains of 2,000,000,000 people with Thought ? What is it thinking about when apart from the brain ? It must have been in existence before man, and it is difficult to understand the reason for such existence, or how, in the absence of a brain, it could think, or what it could think about. Is it that man's thoughts are not his own thoughts at all, but the thoughts projected into his brain by Thought ? Man's thought is closely connected with his senses, and Thought must have some connection with the senses if they both utilize the brain for their purposes. But this would vitiate the principle of Thought apart from the brain.

How does Thought benefit by entering the brain ? If no benefit accrues to it, why does it enter the brain at all ? If it is for the benefit of man that it assumes possession of his brain, what happened to the brain of the lower animals before Thought considered man's brain sufficiently advanced for its beneficial purposes ? If it benefits neither itself nor man, why does it interfere with man's brain ? How does it deal with the varying quality of different brains ?—it is obvious that the thoughts of men differ very greatly. Or does each brain take from circumambient Thought the quantity of thought it needs ?

There must be a point between the zygote and the mature brain where Thought enters the brain. Where is this stage ? Is it at birth ? If so, how can the brain develop from conception to birth without exterior Thought and then suddenly become receptive to it ? It is not enough to say that Thought enters the brain just when air enters the lungs or the heart begins to beat, because these are clearly physical phenomena associated with organic development, while Thought is not. Presumably, man could very well survive without Thought such as this, because his precursors for millions of years did so.

Again, there are philosophers who hold that the whole universe is a universe of Thought only—before it, there was no universe. If this be true, then no atoms, chemical action, atomic structure, existed in the universe until quite recently, because previously they had not been thought of. It is for such philosophers to explain why their metaphysics change with scientific discovery if the universe is a universe of Thought only. To ordinary people it seems incredible that such assertions should be made. When examined, it means that all the universe, of men as well as all else, is brought into existence by any particular person's own mind and goes out of existence at his death, although we can see him die, and we and *our* minds, as well as the universe, still remain in existence. It would be interesting if all these difficulties could be explained away, but probably they do not exist for the philosopher. It is sufficient for him that All Is Thought and that the material universe is created and exists by it, though it is quite independent of matter.

These are, to us, troubled waters. Such vast assumptions should have a basis of evidence that would more or less appeal to the inquiring mind, but we find no warrant in any shape or form for them, and very clear reasons should be given for this " hypothesis " of universal Thought, because without such reasons it is pure nonsense. We cannot but think that the universe existed before men thought and that it will continue to exist when there are no brains to think. But thought is that particular form of Intelligence that has enabled man to develop to his present condition, and a better understanding of it will undoubtedly make clear, even to the philosophers, the meaning of the universe—including Thought.

V

There is a definite strain in continued thinking; it is an effort to concentrate one's thoughts, and relief is found in letting the mind wander listlessly or allowing it to dwell on trivialities. Attention often wanders even against intention, and the strain is all the greater when one endeavours to compel the brain to think. Concentrated thought is very new to mankind—so new that attention can be given to one specific object for not more than forty seconds without the attention straying. This may be because self-consciousness is a comparatively modern arrival and, to some extent, artificial. Its relaxation allows the brain to follow the line of least resistance, which tends to bring it under the sway of the senses without paying particular attention to the consequences.

Man is elevated above other animals by his self-consciousness, awareness, attentiveness, understanding, and at present he is evolving much more rapidly in this direction than in physical form. This allows much greater opportunity for co-operation between Intelligence and self-consciousness, and for the better understanding of the meaning of life and its relationship to the immediate environment and the universe. Ordinary conscious life carries on without any special need for understanding how or why it exists. All creatures below man never know, and never can know, the how or why—but they carry on as efficiently as man, and in some ways even more efficiently. It is only in man, however, that consciousness becomes aware of things, becomes conscious of its own existence—becomes self-conscious. The strain of self-consciousness and awareness is far greater than any conscious strain—that is why attention cannot be concentrated on one isolated object for more than two-thirds of a minute; but the brain is impressed by all self-conscious events and registers and memorizes them, readjusts and uses them, just as it does with sense impressions.

In the case of man, one of the problems of the future will be how to ensure that his more or less stereotyped body will keep pace with the restless activity of his brain. It does not appear that his body can make much further progress—it would be difficult to imagine the direction this would take—and the artificial conditions he has introduced would be a check rather than an aid to any advantageous natural change; moreover, such changes would have to be genic and would need to be preserved by man himself after they appeared, because Natural Selection now operates very little on man in relation to his external environment. The only possible way, seemingly, would be to breed human beings for special "points" in the same manner that domestic animals and plants are bred; but this has its dangers and perhaps impossibilities, and nature may not respond to man's prophetic manipulation of himself in just those ways he may think would be to his benefit. The alternative, though limited, is for man to readjust himself to nature and build up a strong healthy physique, leaving the rest to Intelligence.

One may hesitate to accept the idea of a general control over the development of the body, over all the functions of the organs comprising it, over the division of the countless millions of cells of which it is built. We are apt to give up in despair all attempts to understand it, and to assume that it is unintelligible even if true; but this is dangerous, and opens the way to superstition and the drift towards an assumption of fictitious external controls.

Remember that Intelligence comprises the universe and controls it. Its power increases as its complexities increase, because it always precedes action and no action can take place without it. Well, then, Intelligence must be exceptionally powerful in the cell—in every cell—and still more so in the organized body, for it is greater than all the organized structure and functions of the body.

It is stated by anatomists that function precedes structure. How can there be function without the thing that functions? Is it in the mind, like the ideas of an inventor? If so, this is Intelligence. But how can function know what sort of structure is required to perform its needs? It sounds a little like the problem of which came first—the hen or the egg? A little thought will show that structure and function develop simultaneously, and it is impossible to say which precedes the other. Though some structures take on new functions, the change is so gradual that it is unobservable, or practically so, in successive generations.

An atom is a highly organized structure relative to primitive substance, which means that at the atomic stage of existence Intelligence had developed enormously from its primitive condition. In the carbon compound it has again progressed far beyond the atom, yet it has not yielded up its existence as a mitron—it has incorporated it in that of the atom and the compound. Development is not an intrinsic change in the nature of Intelligence, but a greater power of its expression due to the more complex conditions and structures which have arisen in succeeding generations and which enable it to exercise ever greater controls.

Thus, in the human body it consists of a linkage of all mitronic, atomic, molecular, cellular, organic, nervous, and mental activities, acting either as one unified system or individually, according to place, time, and circumstance. The alternative is that all human life, thought, understanding, reason, emotion, intelligence, must be just chance happenings, the outcome of unintelligent, enigmatical, incomprehensible, unknowable forces or laws which are guiding humanity to some sort of destiny and driving them on without intelligence, for laws themselves seem to be without any guiding principle so far as man is able to discover.

VI

By what right, by what authority, do we assume man's reasoning to be unerring in its conclusions? Only by the fact that it has enabled him to survive. Reasoning consists of putting the mental impressions of events in relation to each other in such a manner as to enable them to be recognized when they occur again. Without such mental arrangement, events could never be rationally associated together and the brain would be undecided how to deal with them. Such a brain could not deal with critical situations, and the possessor of it would not long survive.

Survival, for mankind, is the test of whether the things we depend on will support our existence—if they do not, we should not survive. Thus, if our reasoning were not correct we should arrive at incorrect conclusions, we should not know the exact meaning of anything, all our thoughts and hence our actions would be confused, and these incorrect conclusions would prejudice our chances of life. We exist only because our reasoning is correct; therefore we conclude it is reliable in its results. We unhesitatingly use the same method of reasoning in relation to matters which are not so immediate, not so eventful—logic, behaviour, generalizations concerning laws and theories—and we feel we are right in doing so because reasoning serves the purposes of life so satisfactorily. Our existence is our guarantee, our authority, for assuming the unerring nature of reasoning for all purposes affecting ourselves and our existence. There may be other forms of reasoning, but we are not aware of them.

Sense impressions are the raw material of reason, and these impressions received through the senses, and placed in proper order in the brain for either immediate or future use, comprise that memory which is herein deemed to be so important.

Millions of men in all parts of the world cannot reason accurately, but they survive and breed. Natural Selection has no effect on Abstract Reason; men do not die for lack of it, nor does it prejudice their lives if they possess the power of it. Therefore it is not an inherited character; it does not occur in the gametes. It must arise anew in every individual as the product of somatic Intelligence.

The relationship between cause and effect is an important factor in reasoning. We are apt to think that causes always have effects and that there is no effect without a cause. This is but partially true. A cause implies an effect, but the effect may not be known. An effect infers a cause, and the cause is usually known. Here is a fire, it may be the cause of many kinds of unknown effects—of panic, of death, of the boiling of a kettle, of a red-hot poker, of a burnt stick, of a comforting warmth, of the destruction of a city, or of nothing but heat and the products of combustion. The effects of causes are therefore limited or controlled by the environment of the cause, and a cause does not exist for the purpose of creating an effect, a great many effects being accidental, unless there is an external motive which arranges a cause especially for the production of a definite effect, as in chemical and other experiments and in many human operations. But effects are always linked to causes, and most human actions are the effects of causes, though the causes do not compel the particular effects. A smell may exist without a nose to smell it, even though noses are for the purpose of smelling.

The different effects ensuing from one cause give opportunities of the expression of free will. It is irrational and a psychological crime to limit man's Intelligence to a rigid routine of cause and effect. It eliminates all imagination, poetry, art, joy of life. If it could be proved to be true it would have to be accepted unhesitatingly as a part of our fate or destiny, and we should adapt ourselves to it as part of our environment; but it has never been proved to be even reasonably true. All through life many of our actions and thoughts are in direct contradiction to it, and it is only too common to find that our free choice interferes with or influences our decisions in both great and small affairs of life.

During the increasing complexity of development from mitron to man the limits of free choice expand greatly. Free choice, or free will, in man is denied by many psychologists and others because of the direct relation between cause and effect observed in the more limited world of physics, chemistry, and mechanics—and in the opinion of philosophers. They say that free will is impossible on account of the obedience of matter to law, and must therefore be impossible throughout the universe. They overlook the occurrence of exceptions to, and breaches in, the laws they themselves have invented, laws which have no warrant in fact and are only positive statements of approximations to an observed regularity in a sequence of events. As matter progressively develops into various forms—atoms, elements, inorganic compounds, colloids, organic compounds, living matter, plants, fish, insects, birds, mammals—so there are more and more possibilities of freedom of choice. It is found in the varying isotopes of the elements, in the different affinities of the atoms, in the changes in inorganic compounds, in the instability of the colloids, in the movements of primitive protoplasm, in the adaptations of early living things to their surroundings, in the budding consciousness of the vertebrates, in the self-consciousness of man. The more the Intelligence is able to express itself the more the individual possesses freedom of action, until in man it reaches its maximum up to the present time, and his power of control over his environment can be attributed only to his free choice or free will. Reflex action, intuition, instinct, are so important that no organism could survive without them, but these are inherited methods of adaptation which at one time were the ways adopted by the free will of the individuals of the race in the effort to maintain existence.

VII

The determinist or mechanist asserts that human beings are but highly complicated mechanisms, that we can only act as machines. That may be true, we may be machines of some kind, but certainly not the kind the materialist has in mind. If a machine stops or is stopped, how is it started again ? It cannot start of its own accord ; something apart from the machine—a belt, chain, current, something exterior to it—must start it. When an organism is in repose or asleep no outside influence or power is called upon to reanimate it ; it wakes into complete life again without any external aid, and only death, with the dissipation of the organism, prevents it from becoming reanimated. The machine, however, may rest for a moment or for many years, and may be set to work again by a suitable source of external power ; but when not at work it is really an association of inert inorganic materials made by an agency other than itself and operated by an agency apart from itself, and is useless corroding matter without such agencies. These external agencies controlling the machine are living organisms, men, who are themselves stated to be machines—a complete inversion of the meaning of words and ideas.

The determinist asserts there is no free will and no choice of selection of alternatives. Looking back, this appears to be so; in many cases one can see why one chose this or that action, and the reasons for doing so seem to be determined not by our free choice but because some previous occurrence or occurrences induced us or compelled us to adopt that action. But, looking forward, we find we may do this or that; we may take the road to the right or the road to the left. Determinism says we have no choice; previous occurrences, however remote or however obscure, compel us to take one definite way, although we seem to think we can choose. But there is a fallacy in this. If the determinist is correct we have not only no choice but no alternative, for we should, without any thought or hesitation whatever, go to the right or to the left and the other one would not exist at all for us. To admit an alternative is to admit that previous experience does not compel us to follow only the one path, which means that free will is also admitted. To assert there is no alternative is to assert purpose, predestination, fatalism, teleology. It also denies chance and free thought—one cannot have free thought if there is no free will. And to deny free thought is to assert that thought is compelled to follow predestined lines and to "think for one's self" is an impossibility. Yet without freedom of choice, or free will, the universe could never have begun, no change could ever have taken place, and there could be no evolution; so the logical result of determinism is that we are still particles without any form or movement and all our existence is a fantastic thought in the matrix of the universe. Which sounds almost like philosophy.

But whenever more than one way, one action, one thought, presents itself, we do choose, whatever it may be that induces or compels us to choose. Our emotions, our behaviour, constantly change, and what at one time would arouse our anger will at another arouse only our contempt; what would cause us grief causes us only amusement. There are, obviously, general tendencies in each individual, but many of these may be controlled, modified, or eradicated by self-discipline or by wider knowledge; so the effect of free will is achieved even if it is stated pedantically that it does not exist. And, inasmuch as we can choose and we do choose, our power of choice indicates a selection of one way or the other—the very opposite to compulsion.

It is because the environment of the organism repeatedly drives it along definite lines that free will is denied to the organism, but it does not follow that because forces more powerful than itself drive an object along a certain path that it has no will or choice of its own when the forces are removed. Consider the pig! It would be a miracle if the object could choose its own path against such forces, it would mean that the lesser Intelligence could act in opposition to the greater Intelligence, which is impossible. Intelligence does not perform miracles; if it did it would be neither intelligent nor intelligible.

There is a constant adjustment between the free will and the environment. When higher organisms are born they have a very high potential free will, and endeavour to dominate their environment, but they soon become limited or circumscribed—chiefly by the organic environment, and especially that of their fellow-organisms—and, as the senses come into operation and impress the brain with stimuli, free will becomes more and more subject to the influences of the environment and adapts itself to it. Memories are stored, emotions and passions are controlled, habits are formed, and the organism falls into the routines and restrictions of its fellows.

VIII

The senses are the means which enable us to understand material things. Abstract thought is speculative. All thought, all speculation, all reasoning, must ultimately be about possible occurrences to, or about, material things; they must be based on phenomena that have happened, will happen, or are happening. Take away matter, and *thought has nothing to think about.* Thought is the result of all our experiences, therefore we can understand matter existing without thought more easily than we can understand thought existing without matter.

Sense impressions are the registration in the brain of the contacts between the nerves of sense and the exterior environment—the events of life. The eye sees a figure—a building, a horse, a cloud—and this sight is registered in the brain. But the building, the horse, the cloud, is not in the brain—it is only the effect of rays of light on the retina that pass to the brain. These rays, which are of colour only (the colours of the spectrum, together with black and white), pass through the cornea, the lens, and the vitreous humour, to the retina of the eye.

The nerve-cells, the fibres of which terminate in the retina, are excited by the impact of colour vibrations on the retina, and the stimulus passes to the brain through thousands of fibres, the terminal extensions of the nerve-cells—the vibrations affecting not one or two cells, but many thousands. In this manner the form, size, and colour of everything we see are impressed on the brain. Each fresh stimulus sets its particular nerve-cells tingling, and response is made according to the nature of the stimulus received—touch, sound, sight, smell, taste. Most of these are receptive only, and their impressions are stored. In the case of touch a return stimulus is usually sent down an efferent nerve to the muscle controlling the part from which the impulse has been received, and this muscle contracts, thus removing the part from the cause of the stimulus, if this is painful.

The cortex of the brain consists largely of internuncial neurons—nerve-cells without long fibres. The neurons which are in direct communication with the senses consist of nerve-cells in the cortex the fibres of which extend to the receiving organ, where the ends of the fibres are sensitive, and between these neurons and the internuncials are the synapses. The brain and its extensions thus form one intricate apparatus for receiving, sorting, storing, and transmitting stimuli—they are received from the senses or the brain itself, sorted and stored by the internuncial neurons, and transmitted by the motor nerves.

The synapses are extremely important. They seem to be gaps between the dendrons of the receptive nerves and the fibres of the internuncials. Their function is to exercise some sort of control over what shall pass between the nerves—a sort of censorship, but one which may be overcome by repeated stimuli of the same kind which seem to weaken the resistance of the synapses. Little is known about how they function, and it is thought to be chemical, physical, or electrical by different neurologists. They seem to act also as shock-absorbers—to reduce the stunning effect which a very strong stimulus would have on the cortex. Shell-shock may be due to the explosion breaking down the resistance of the synapses which control sound. A blinding flash of light has the same effect, and the after-effects of a major surgical operation are well known even when the operation is quite successful. A full understanding of the synapses and their functions will lead to a much greater knowledge of the relationships between the senses, nerves, brain, and thought.

Many stimuli never reach the brain; they are reflexed directly from the spinal cord. But the principle of Intelligence applies to them just as to those stimuli which are dealt with by the brain, because these reflexes existed in lower forms of life long before the advent of man.

When a man takes a line of action, this tends to be repeated on a subsequent occasion. The tendency to repetition arises from an impress made on the brain by the original action. To repeat an action exactly is to make no progress, no real change; but nothing is repeated exactly —it may be mentioned again that even the sun which seems to arise without change every morning is not the same sun as that which arose yesterday. So it is with everything; change is essential to the continuity of every part of the universe, which means that no action is ever repeated exactly.

Memory is the term used for a sense impression of a more or less permanent nature. We do not know what this impression is, how it is made, or how it persists until it is re-memoried—remembered. We only know that the brain has been so impressed and that the impression does persist because, in the first place, we recognize a thing we have seen, heard, or tasted before, and therefore some impression must be there; and, in the second place, if we had no such impression, everything we see, hear, touch, taste, smell, would be new every time it affected our senses, and we could not exist if such were the case.

Inasmuch as the brain consists ultimately of atoms and molecules, it is reasonable to suppose that the nuclei of the internuncial neurons of the cortex may be in a particular molecular condition, and a new impression made on them by a physical or mental stimulus alters this condition for a time; a second similar impression deepens or tends to fix this condition, and each similar impression fits more easily into the previous condition—this fixation is memory. These stimuli probably have the form of vibrations—chemical changes or changes of position would seem to be too slow for the purposes of thought. Thought may be conceived as a disturbance in these vibrations. As the brain is always thinking, these disturbances are continuous in one or other part of it. Stimuli may be received either from the senses or from thought, and many nerves are affected by one impression or one thought.

Thoughts become associated with memories of similar things or ideas—that is, with neurons the molecular vibrations of which harmonize with the general trend of the thoughts; the disturbances then subside, and the molecular vibrations—the memory—become more deeply fixed or become slightly changed if the thoughts introduce a new or a broader aspect of the subject thought upon. The content of the mind is enlarged by changes in the vibrations or by fresh neurons becoming functional—that is, by the fibres forming sheaths under the influence of the extended action of the brain (see p. 49).

Memory and the manipulation of memory are thus the basis of all thought, and are perhaps the most important influences in life and in the universe, next to Intelligence.

IX

With brain impressions, memory, consciousness, thought, reason, as a basis, all phenomena are correlated and all the results of thought are brought into rational relationships as new arrangements of memory. The more one thinks about a thing—that is, revives the memory of it—the greater the fixation of impression. The organism cannot adjust itself to a benefit or a danger of which it is not aware; but immediately such a danger or benefit appears, past experience enables the organism to adjust itself more or less rapidly to the new situation. Past experience, which is intelligent memory, thus preserves or benefits the organism.

Memory is the impression made on the individual by contact with its environment, and may be great or small according to the strength of the impact. If small it soon dies away; if great it persists for some time. But a repetition of small impacts will increase the memory of that event if these impacts follow one another before the previous ones have faded away.

The self-conscious, the conscious, the subconscious, the unconscious all consist of memories. If not, they would be non-existent, there could be no sort of consciousness without memory. The self-conscious is the understanding of the meaning of what we are doing and thinking. The subconscious lies just below the "threshold" of consciousness as nascent memory, ready to become conscious in the sequences of thought, or to well up into consciousness when we are "thinking of nothing at all," in which event it may be called reverie or day-dreaming. Reverie is often an indication of character, and thoughts of unattainable desires and wishes frequently occur in day-dreaming. The unconscious is the more or less automatic control of involuntary actions such as reflexes and instincts, together with experiences which rarely come into consciousness unless induced or compelled to do so by circumstances in the environment, or in remembered dreams. It consists of stored or embedded memory, memory which is latent or passive.

Memory is generally in an unconscious or subconscious condition because if all memories were conscious the whole of memory would always be present and connected thought would be impossible; such a condition would be virtually asanity.

All understanding, reasoning, thought, memory, consciousness, are phenomena of the brain, which is the physical basis of memory and reasoning. The impressions received by means of the senses are exterior to the brain, and are the foundations of its activities. Nothing organically new originates in that part of the brain (nerve-cells or their inclusions) which understands, reasons, thinks. All these cells do is to juggle with, re-assort, or re-arrange the impressions received. All abstract thought, abstract morality, abstract ideas, revealing, dreaming, have no other source, no matter how fantastic they may be. The idea that the universe and all in it, including men, is but a thought in the mind of a creator is an extreme example of abstract thought —and it is obviously based on a brain, a human brain. For a creator cannot think, or have a mind to think with, unless he is limited to a merely super-*human* existence. Thus our Intelligence tells us that all these terms—understanding, reason, thought, memory—are but the result of the brain receiving, registering, and manipulating impressions (sensory stimuli) from the internal and external environment—we think about things, we understand things, we reason about things, we have things in mind. Say " ideas " as well as " things," and the process of thought is complete; but ideas are only the representation in the mind of things outside it. A chair does not exist in the mind—all that exists in the mind is the idea of it, the representation of it. But unless a chair existed outside the mind the idea of it could never occur, so ideas of things depend on the things themselves—the actual things outside the mind. All this is only an endeavour to clear away the confusion of terms which mean sometimes one thing, sometimes another, sometimes nothing at all comprehensible. We need concern ourselves only with the brain, with Intelligence, and with that convenient word, " mind."

There is a general feeling that " mind " is something apart from the brain, that it has some control over the brain or over one's thoughts or mentality, that it is in some way connected with sensation, that we can do something with it. We say " to my mind " and talk of " the mind of man "; we can " make up our mind," " speak our mind," " turn over things in our mind "; or we can be " in a frame of mind." These all refer to our way of thinking or the manner in which we express thoughts and opinions, or they indicate the general content of our thought. But there is no such thing as " mind," and in itself the word has no meaning; it is one of those words, like Natural Selection and others previously mentioned, which are very convenient if strictly limited to their purposes, but which cause much confusion by being misapplied or endowed with fictitious qualities. The word " thought " is just as good as " mind " and far less confusing; nevertheless, " mind " and " mentality " may be freely used so long as their limitations are understood.

X

Much investigation has been made into mind, character, and behaviour by psycho-analytical methods, but there is a good deal of confusion in connection with the premises and the conclusions drawn from this investigation. That mind and body can influence one another is well known, but how they do so is less well known. The psycho-analyst deals with the mind as it affects conduct rather than the body, and especially emphasizes the relationship between the conscious and unconscious states of the mind and the effect of repressions, resistances, and inhibitions of consciousness on behaviour. The conclusions of psycho-analysis have not received general acceptance in spite of their great interest, the reason being that these conclusions are not justified by the evidence, and its interpretation of the mechanism of consciousness and unconsciousness is so vague and so far-fetched in some directions that no sound science can be based on it. For instance, it is stated that the seat of mind and body relationship is the unconscious, an inactive state of mind where certain mental elements exist which are not available to consciousness except in special circumstances. These elements are in segments which cannot get into contact with one another owing to resistances between them, nor can they rise into consciousness because of repressions which prevent them from doing so. The unconscious is quite inaccessible to the conscious, yet it prompts the working of conscious thought, there being a free association between the conscious and the unconscious. How the accessible and inaccessible relations can be reconciled is not very clear.

The unconscious is asserted to be dynamic and to reside in the depths of the mind (it is such phrases that make the subject difficult to follow), and it comprises certain primordial impulses and instinctive urges constantly welling up to find relief or satisfaction. What a primordial impulse is we do not quite know, nor can we imagine the state in which these impulses and urges exist in the mind—or where they are situated in the brain. The unconscious is called the id, which is divided into an ego which contacts with the environment, an unconscious portion, and a super-ego which watches over the relations between the other two and exercises what is called a " censorship " between them. That is, the super-ego warns the ego not to accept any repressed impulses from the id. But, as just stated, the ego, the super-ego, and the unconscious part of the id together comprise the whole id; so the meaning of this warning is somewhat confusing. The confusion is increased by the remark that after the ego is cut off from the id, the rest of the id is then called the id, and the ego divides into the ego and the super-ego. This sort of statement occurs frequently in the terminology of psycho-analysis and makes it very difficult to understand. Descriptions of " mind " and behaviour suggest a material basis of the mind and it is definitely stated that " A large part of bodily energy may then be shared by two principal organs, the brain and the psyche." But where such an organ as the psyche is situated is impossible to understand, because it cannot be in the brain, according to the foregoing assertion, yet it is a " principal organ " of the body.

Here let us point out an extraordinary error which apparently psycho-analysts have overlooked. It is stated that psycho-analysis stands or falls by the Œdipus complex. This complex is a condition of the mind which prompts a child to fall in love with its parent of the opposite sex and to desire sex relations with him or her. It usually applies to the boy and his mother, but it may also apply to the girl and her father. This is the central complex in the whole of the unconscious, and the future of the child is stated to depend on how it reacts to this complex.

But why " Œdipus ? " Who was Œdipus ? According to Greek myth he was the son of Laius and Jocasta, king and queen of Thebes. An oracle informed Laius that he would die by the hand of his son, so when Œdipus was born Laius ordered his feet to be pierced and bound together and he was then exposed on Mount Cithaeron. But he did not die; he was found by a shepherd and taken to King Polybus of Corinth, who called him Œdipus because of his swollen feet. He was brought up as the child of Polybus, and when he grew up he was told by an oracle that he was destined to slay his father and commit incest with his mother. This horrified him so much that he fled from the court of Polybus —his father, as he thought. On his flight he met Laius, his father, and, after a quarrel, slew him. In the meantime a Sphinx which had been ravaging the neighbourhood of Thebes announced, after the death of Laius, that whoever solved a certain riddle would become the King of Thebes and marry the Queen. Œdipus solved the riddle and duly became King and married Jocasta. They had several children, but a plague visited the country because of the incestuous relationship between Œdipus and Jocasta. Moreover, the oracle ordered that the murderer of Laius should be expelled from Thebes, and Œdipus pronounced a curse on the murderer. He was then told by a seer who he really was, and he was so shocked that he put out his own eyes and Jocasta killed herself. Œdipus was banished from Thebes.

Now examine this story. Œdipus had not the faintest idea that Jocasta was his mother. He married her for purely political reasons, and so far from falling in love and desiring sex relations with her, he was devastated when he learned of what he had done, and his mother was affected in the same way to such an extent that she killed herself. The whole of the story is entirely inconsistent with the " Œdipus complex " of the psycho-analysts. This extraordinary inversion of meaning, or distortion of fact, is by no means uncommon in psycho-analysis, and this basic Œdipus error is repeated many times in the interpretation of psycho-analytical research. Unconsciousness is confused with ignorance. Hostile feelings are stated to be reactions against imagined attacks, which is quite true; but it is also stated that inner opposition is a resistance against self-knowledge, which is contradictory.

This Œdipus complex becomes so stressed and magnified that " All sorts of reactions (emotional displays, ideational disorder—delusions, hallucinations, behaviouristic disturbances) may be the symbolic representatives of a defense against the reversion to childhood and its consequent dependence upon the family unit. Technically this is called the Œdipus complex."

All children are stated to take a primitive pleasure in playing with dirt, but surely this is not because it is dirt, but because it is usually the nearest convenient thing to play with. Give them simple toys, buckets, sand, anything they can pick up and shake and drop, and the attraction of dirt ceases. They are supposed to take a delight in playing with their excreta, but though we ourselves have observed the playing of children for many years we have never seen this, either in the slums or elsewhere. It is said that children *conceal from themselves* the sexual nature of their interests—could absurdity go further? Apparently child psychology consists chiefly of trying to smell out stinks which are not there. Even dancing is said to be derived from sexual impulses and desires, but it is much more an expression of superabundant energy and lightness of heart, and as it would be unreasonable and unsociable for youths and maidens to dance by themselves, they dance together—hence the psycho-analyst sees a sex motive in it.

It is generally assumed that psycho-analysis applies to all persons, normal and abnormal, but it should be clearly understood that it deals only with the analysis of diseased mentality and the effort to bring it back to normal. In this admirable study it is regrettable that such grotesque interpretations of character and behaviour should be suggested. These are even projected into history, for in explaining the advanced stages of schizophrenia, when the final stage is achieved "the patient's psyche bears a remarkably close resemblance to that observed among primitive peoples. It appears that the patient has regressed beyond his own ontogeny and has fallen back upon phylogeny." This means that those people from whom all modern people are descended were in a state of complete and permanent insanity. A remarkable conclusion, but one which would account for many modern customs, conventions, beliefs, and social practices and behaviour.

It would be tedious to go further into this subject; but we may hazard the suggestion that a close study of the origin and development of the nervous system and the endocrine glands, together with a knowledge in detail of the structure and function of the various parts of the human brain, as well as exact observations and analyses of the effects of artificial environmental conditions on inherited tendencies, free from obsessions and prejudices, would probably lead to a more scientific understanding of the mind and the various phases of consciousness. Such an equipment would be a check on the seemingly irrational and fantastic conclusions to which we have drawn attention, and psycho-analysis might then take that place in the hierarchy of science which is long overdue.

The subject is particularly interesting to our theme because it introduces a " censor " which controls the relationship between the conscious and the unconscious. This censor seems to be one form of Intelligence, and a re-examination of the facts on which psycho-analysis is based may reveal the methods of Intelligence in relation to these facts.

XI

No one would suggest that all the unsolved problems of science can be explained by Intelligence alone without referring to natural causes, because nature is the way of Intelligence. But note how difficult it is for scientists to evade it and how materialistic science is constantly calling on miracle for explanations. Consider these few out of a vast number :—

> There exists in the nervous system a mechanism whereby *ideas present in the mind* can exert a real influence on bodily tissues and organs.
>
> Systems of organs are laid down. These each *elaborate their own plan.*
>
> The development of muscular power in hypnotic trance must be *due to an antecedent power* in the nervous system.
>
> Under similar adverse conditions, a victorious army can be immune from the ravages caused by the same conditions in a defeated army.
>
> Regeneration is one of the manifestations of the *self-regulative powers* of organisms.
>
> In the formation of the germ-cell each tetrad *decides for itself* which synaptic mate goes into the daughter cell.
>
> The attributes of colloids . . . are emergences of that *primal power* to respond to irritability *that is innate in all inorganic matter.*

The realizations of the characters in polyploid plants compared with those of their diploids are *contrary to the mechanistic conception* of the nature and behaviour of the organisms.

Harmony of the parts in subordination to the needs of the whole is one of the conditions of existence for higher types of life.

We shall then discover that all our present definitions of matter are incomplete, and that the " world-stuff " is in reality endowed, not only with the properties of what we call matter to-day, but also *with those of mind.*

An equally important factor has been the *increase in harmony,* in co-ordination between the parts and between the actions of the organism which, too, is dependent on the elaboration of the structure of the brain.

A new bit of chemical machinery *has been introduced somehow* into the organism.

It was suggested that the " *disobedient* " *electrons* might be tightly bound to heavy particles, to be set free only in the processes of β-disintegration. Actually, this came very near to what is currently accepted for the truth.

The foregoing are not all exact quotations, some of them have been rephrased slightly for convenience; the substance is correct.

And note the following scientific opinion from a recent book on mechanism in relation to evolution: " From electrical actions of protons, electrons, and atoms and the autocatalytic reactions of genic molecules there is a regular sequence of the evolution of the mind through the tropic responses of pre-cellular, uni-cellular, and multi-cellular organisms to the reflex mind of vertebrate animals, mammals, primates, and anthropoids, until finally conceptual mind arose in certain genera of the Pliocene ape-men and developed later in our own genus Homo, with the most rapid progress in our own species, Homo sapiens, during the last 8,000 years. No deterministic system, scientific or philosophical, could possibly have predicted life from matter, or mind from life and matter. Comparatively recently, about ten million years ago, the super-kingdom of Conceptual Mind arose in mankind associated with a complex brain structure and nervous system which had developed as a gradual evolution of life and matter. New species of the kingdoms of animals, plants, and protists will arise on the earth in future as in the past. In the distant future we may infer that new kingdoms of living organisms other than animals, plants, and protists will arise and that in the course of time a succession of new super-kingdoms will gradually come to pass, each great step surpassing and transcending conceptual mind to the same degree and extent that mind now transcends life and life surpasses matter. Mind is gradually increasing in influence and matter decreasing. Human selection is gradually replacing natural selection. Creative evolution may be speeded up considerably. The influence of matter will be considerably reduced and replaced by mind and its unknown successor. Such an independence of matter would enable our far-away descendants to leave the earth and to visit and people other planets in our solar system or other stellar systems of our universe and even in other universes if they exist. The remote successors of man may be free and independent of matter, with infinite possibilities of future progress notwithstanding the complete dissolution of the universe."

That is a serious scientific opinion of the future, and this Intelligence we are endeavouring to expound pales in its shadow—but what a glorious hope! Unfortunately, we—you and us—will be dead then, and it is for the urgent, exigent *now* that this book is written.

XII

It may be interesting to note the distances of time between the epochs of development; the following is a rough estimate of when they began.

It is quite impossible to state even approximately when the first change took place in primitive substance, but to bring it into line with subsequent epochs it may be put at . . .	1,000,000,000,000,000 years ago.
From that time development seems almost stationary, the only change being from primitive substance through the hypothetical mitrons to units of accumulated energy akin to proton, electron, photon—units which would appear about	500,000,000,000,000 „ „
The great gaseous nebulæ formed from atoms and condensed into the stars were in existence	200,000,000,000,000 „ „

Our sun began to shine nearly	5,000,000,000,000	years	ago.
The earth, which was torn out of the sun, condensed to a liquid state	5,000,000,000	,,	,,
It solidified into the mountain ranges and the valleys of the deep oceans	2,000,000,000	,,	,,
The formation of the complex organic colloids took place roughly about	1,000,000,000	,,	,,
From these the primitive organisms, somewhat similar to eozoon and amoeba, arose about	750,000,000	,,	,,
The most primitive animal forms such as the sponges and the worms came into existence about	500,000,000	,,	,,

The foregoing rough approximations are borne out by periods estimated from the action of radio-active matter; most of the following dates are based partly on radio-active matter data and confirmed by geological evidence.

Fishes appeared	400,000,000	years	ago.
Insects ,,	300,000,000	,,	,,
Amphibia (toads, frogs, etc.)	250,000,000	,,	,,
Reptiles	200,000,000	,,	,,
Marsupials	150,000,000	,,	,,
Mammals	75,000,000	,,	,,
Lemurs	50,000,000	,,	,,
Monkeys	30,000,000	,,	,,
Early apes	25,000,000	,,	,,
Early ape-men	20,000,000	,,	,,
Man-like Apes	10,000,000	,,	,,
Ape-men	5,000,000	,,	,,
True men	1,000,000	,,	,,

After this period, men split up into several types—Piltdown, Taungs, Java, Pekin, Heidelberg, Neanderthal, Galilee man—the highest being the

Palæolithic Cro-Magnon Man originating	40,000	years	ago.
This type began to disappear about	20,000	,,	,,

Later men arose from a less intelligent stock than the Cro-Magnard.

Modern men—white, yellow, black, red—are supposed to have arisen from one stock which existed contemporaneously with the Cro-Magnon man.

If the remains of stable social conditions as disclosed by archæologists are considered to be historical, then historical man appeared nearly	12,000	years	ago.
Written records are discovered dating back to	7,500	,,	,,
Greek civilization appeared	2,500	,,	,,
After the Dark Ages, scientific man reappeared	350	,,	,,
Progress was then rapid and research man arrived	100	,,	,,
Radio-active man followed	40	,,	,,

This brings us to the present day, and it must be remembered that the above dates are all approximate beginnings of these epochs.

It will be seen that the crescendo of development has become faster and faster and the time between epochs shorter and shorter. Of what will future development consist? No one knows! It seems to be something apart from us, something over which we have no power of control. But it portends a rapid revolution in man's attitude to humanity, or his equally rapid extinction. If, however, our reading of the pages of development is correct, we find written therein a very definite aim—not so much towards a goal to be achieved, but towards a state of living which will make of life a privilege, a magnificent adventure, and a glorious song. The way is clear, though strewn with a thousand hazards mostly of our own making, but we are compounded of that great Intelligence which forms the basis of all existence and which guides us throughout all our development. If we will orientate our lives towards it, the difficulties of the future—near and far—will be but obstacles to overcome, not calamities that will destroy us.

XIII

The object of this book is to emphasize the two principles of an all-pervading Intelligence in the universe, and the non-intervention of any power external to this Intelligence. To this end the relationship between man and his environment, and the development of man as a part of Nature, together with his social progress, have been dwelt upon, while in the last six chapters the scientific aspect of the evolution of matter and man have been examined as briefly and concisely as possible—though, we fear, very inadequately.

It has been difficult to determine what to include and how to make clear many important details, especially in these last six chapters; indeed, a volume would be needed for each if full justice is to be done to the subjects, while some of them—colloid chemistry, cytology, embryology, neurology—are not easy to present in a simple form and at the same time to demonstrate their importance. Moreover, we have tried to avoid extending the argument to the point of mental fatigue, as this would tend to defeat our purpose, and an endeavour has been made to explain the general situation in such a manner as to enable anyone without special knowledge to follow the reasoning, to realize man's position in relation to the universe, and to appreciate how essential it is for his ultimate welfare to cut out all ideas and beliefs that will not stand the light of truth.

Whether these principles and our argument will have any appeal to those who find the present conditions of individual and social life unsatisfactory we cannot tell, but if they induce such people to think things out for themselves with open minds and a determination to accept only those truths which are incontrovertible and not to falter at the difficult places, we shall be well content.

To conclude : We find that the Intelligence of any organism is the accumulated Intelligence of all the mitrons in the atoms, molecules, cells, and organs comprising that organism, and its power of expression has been increased to an almost infinite extent beyond the mere sum of the Intelligences of all the mitrons comprising it. Each mitron may be likened to a note on a piano ; each has a sound when struck, but when many are struck in harmony, the chords produced are something entirely new. Again, a certain number of tunes can be played on one octave of a piano ; how many more can be played on two octaves, and how many on the whole range of notes in the eight octaves of the ordinary piano ? They are beyond even mathematical calculation. But the number of mitrons in an organism runs into countless millions, and the number of possible " tunes " that can be played on them is indeed infinite ; their music fills all the wide spaces of the world, for these mitrons are the strings of the harp of the universe upon which Intelligence plays and produces the music which is life. And when Intelligence ceases to keep the organism in being, its great harmonies disintegrate into the lesser harmonies, and these again into the simpler chords and notes of primitive things—and so the music of life melts away into the silences until it is strung again to a new music which may be the accompaniment of another and perhaps nobler song of life.

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